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ELECTRONICS Australia

AUGUST, 1973

New Zealand 75c

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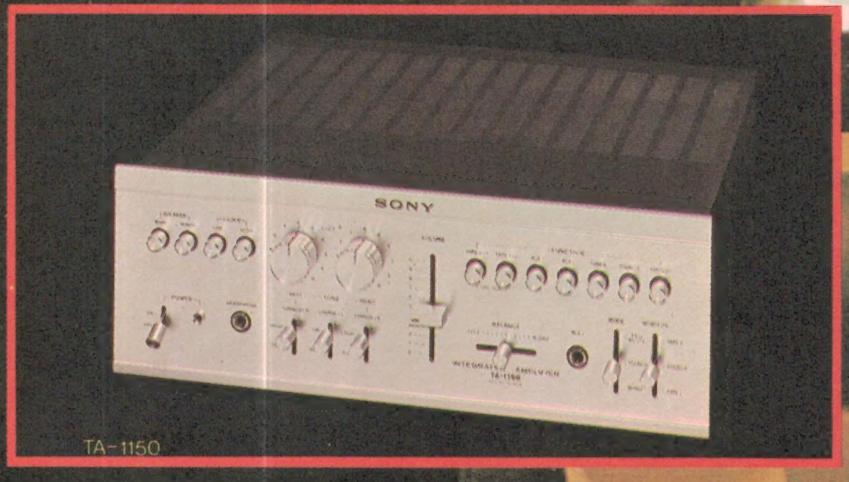

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VOLUME 35 No 5

More and more hi-fi enthusiasts are using stereo headphones. Join them, by building our new adapter. See p.34.

A computer directs this newspaper delivery truck, as our story on p.24 explains.

On the cover

Taken at the recent 8th International Television Exhibition in Montreux, Switzerland, this picture shows two new Philips products being demonstrated. At left is the new LDK-15 portable Plumbicon colour camera, while at right is the new infra-red portable link unit.
(Courtesy Philips Industries Ltd)

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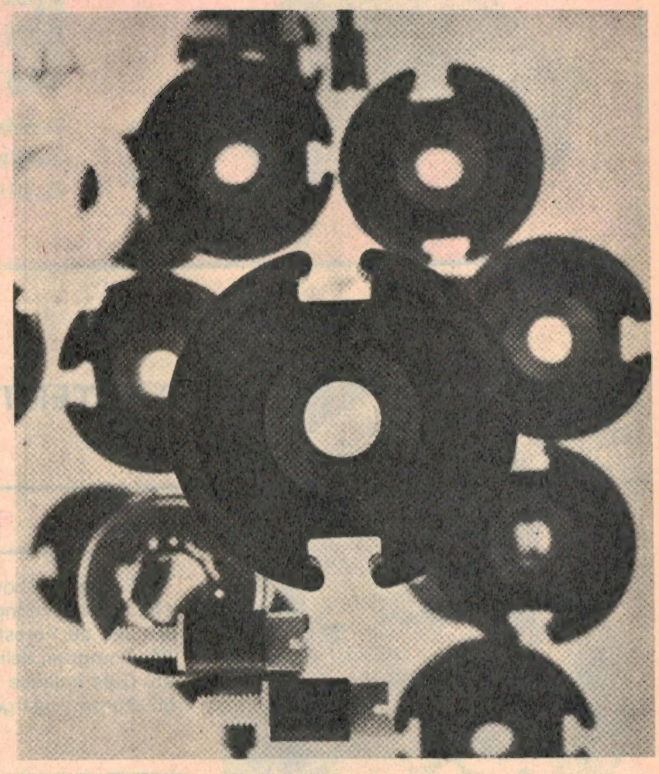
Potcores not pot luck



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25050	3B7	160	76	±1	30960	Yellow
25060	3B7	250	119	±1.5	30970	White
25070	3B7	315	149	±2	30730	Brown
25230	3H1	63	30	±1	30760	Green
25250	3H1	160	76	±1	30960	Yellow
25260	3H1	250	119	±1.5	30970	White
25270	3H1	315	149	±2	30730	Brown
25280	3H1	400	190	±2	31080	Grey
25300	3H1	630	298	±3	31080	Grey
04000	3B7	3673	1750	±25	—	—
04200	3H1	3673	1750	±25	—	—
SEPARATE POTCORE HALVES						
4322 020 21500	3B7	>2770	>1310	—	—	—
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·29260	3H1	250	79.5	±1	30980	White
·29270	3H1	315	100.2	±1.5	30980	White
·29280	3H1	400	127	±2	30810	Brown
·29300	3H1	630	200	±3	30810	Brown
·29310	3H1	1000	318	±3	31090	Grey
08000	3B7	6009.3	1910	±25	—	—
08200	3H1	6009.3	1910	±25	—	—
SEPARATE POTCORE HALVES					$L = N^2 AL\ (10^{-9}\ H)$	
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EDITORIAL VIEWPOINT

Should Parliament be televised?

In recent weeks the daily press has carried reports of the sittings of the "Joint Parliamentary Committee on the Broadcasting of Parliamentary Proceedings," which has been looking into the question of televising Parliament. The reports have been generally quite small, presumably because the newspapers regard the matter as one of minor consequence. I would like to challenge this judgment, and also some of the submissions which seem to have been made.

One report quoted various members and senators as arguing against protracted TV coverage of parliamentary proceedings. Their reasons generally went along the lines that a member making a speech would look ridiculous if the public could see that the House was almost empty, along with doubts about the ability of the public to "correctly interpret" what they might see.

Another report concerned a submission by the Australian Broadcasting Control Board. This apparently contained the results of a survey showing that a majority of the public wanted TV coverage of Parliament, together with a board recommendation that full coverage would not be desirable. The main reasons for the recommendation were apparently that full coverage would be costly and would be likely to attract only a relatively small number of viewers.

It seems to me that both the parliamentary spokesmen and the ABCB have overlooked an important point: the rights of the viewers as citizens. Surely every citizen has the right to see and hear for himself or herself what goes on in their parliament, and they have the right to see all proceedings, not just carefully selected and arranged "highlights."

Let's face it, a member delivering a speech to a near-empty house is being projected into a rather ridiculous situation. But the remedy is not to prevent people from seeing this; it is to alter parliamentary procedure to do away with this sort of situation. And this is far more likely to occur if people become aware of the situation.

It should be our ultimate aim, I believe, to televise not only Federal Parliament but the proceedings of state and local governments as well. Only when all citizens have full and uncensored access to these forums are we likely to generate much motivation to improve the quality of government.

The only legitimate qualification to this is cost. It may well be some time before Australia can afford the additional broadcasting facilities to implement this aim.

— Jamieson Rowe

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The History Savers at work.

David Hall and Sam Sanders discuss a fine point.

Deep inside a building at New York's Lincoln Center for the Performing Arts, recorded history is being recorded again. At the Rodgers and Hammerstein Archives of Recorded Sound, technician Sam Sanders is busy continually transcribing all sorts of old recordings, transcriptions and acetates. Not only will there then be a more permanent record of this valuable material, but access to it is made easy through a sophisticated catalogue system, by which interested persons can hear material that was otherwise unavailable.

The Rodgers and Hammerstein Archives of Recorded Sound are part of the New York Public Library, Research Library of the Performing Arts, and encompass virtually the entire history of recorded sound. But to get these early (and often irreplaceable) discs onto tape wasn't easy. Because until the recording industry established its own standards, playing speeds, groove widths and depths were widely varied.

Stanton engineers worked closely with Archive Head David Hall and engineer Sam Sanders when the Archive Preservation Laboratory was being set up. Standard Stanton 681 cartridge bodies were chosen for their superior reproduction characteristics. However, some 30 different stylus types had to be prepared to give the tape transfer operation the variety needed to match the various old groove specifications. Each was hand-made by Stanton engineers to fit a particular disc's requirements.. So when Sam Sanders begins the careful disc-to-tape transfer, he must first match the stylus to the record. Both microscope and trial-and-error techniques must be often used together. But one of the special styli will enable every last bit of material to be extracted from these recorded rarities.

It goes without saying that a company willing to take such care in helping to preserve recorded history must also be interested in superior reproduction of today's high fidelity pressings. Which is one reason why Stanton cartridges remain the choice of professionals the world over.

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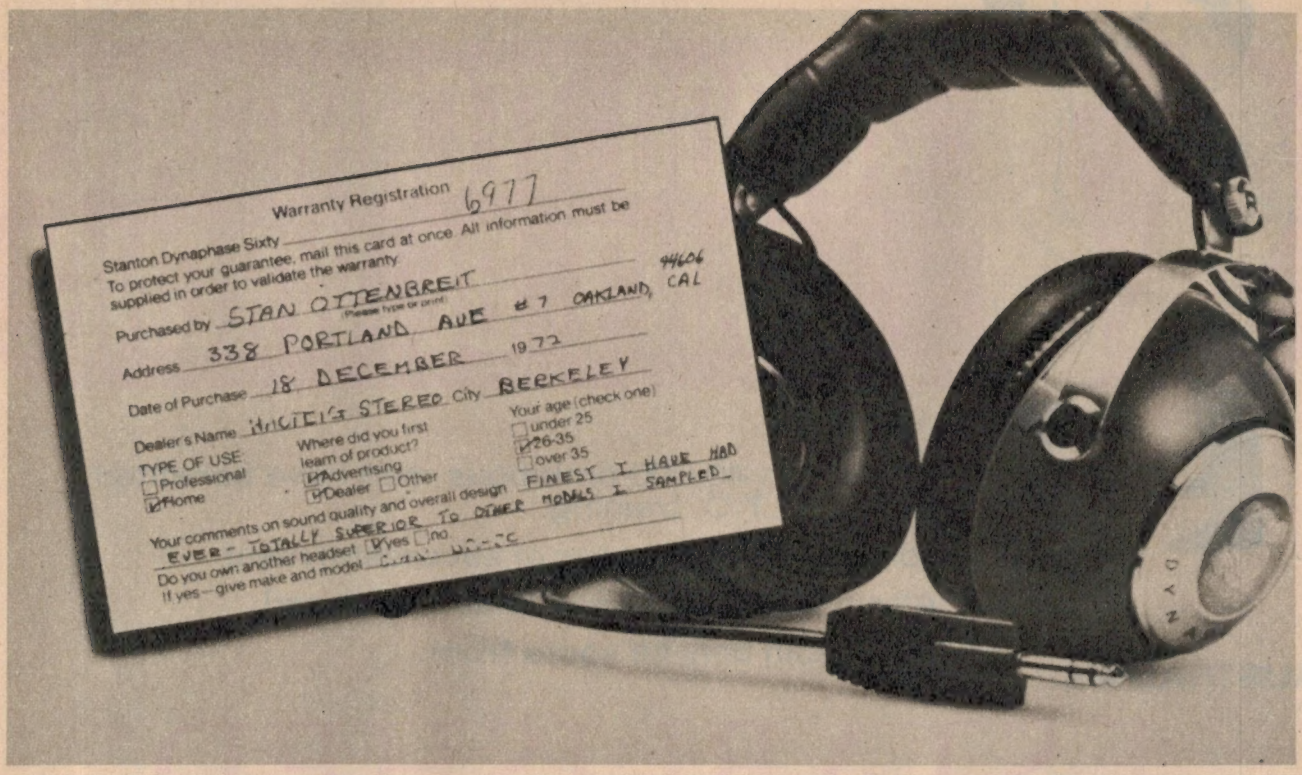

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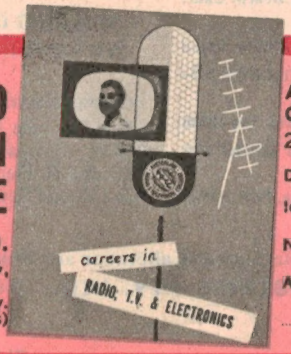

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NEWS HIGHLIGHTS

Success for Australian-made colour monitor

An Australian-made 19-inch (49cm) precision colour TV monitor — type LDN 5006 — was unveiled to the television broadcasting world by Philips at the recent 8th International Television Exhibition at Montreux, Switzerland. Some 18 monitors, specially air-freighted from Australia for the Show, were used as part of the huge Philips display. Visitors to the exhibition were singularly impressed by the quality performance of the new monitor — in particular, its superior colour matching capability. Interest in the monitor has since resulted in potential sales of about 200 units for export to five different countries.

Designed and manufactured by Electronic Engineering Communications, a Melbourne-based (Oakleigh South) division of Philips Industries Holdings, the LDN 5006 has been approved by the parent company in the Netherlands as the standard precision monitor. It will be marketed internationally by the world-wide Philips organisation and in Australia by the Philips Vision and Sound division in Melbourne.

At the exhibition Philips also gave an interesting demonstration of remote wireless control of a new colour camera — type LDK 15 — which features a new image intensifier plumbicon assembly allowing broadcast quality pictures to be produced at extremely low light levels. For the budget-conscious broadcaster, Philips also released two new products — a low-cost colour camera — type LDH 20 — and a cassette audio recorder / reproducer which uses standard format audio cassettes.

Pushing the "innovation" theme, Philips showed a portable, lightweight infra-red beam video link that provides interference-free and low noise broadcast transmission at low cost. Intended for short-haul (up to 1500 metres) program transmission, the link is also a useful companion to the LDK 5 or LDK 15 cameras where even a triaxial cable connection may on special occasions, be inconvenient.

The Philips exhibit at Montreux. All professional colour monitors used were the Australian designed and built LDN 5006.

Another new release was the N1520 video cassette recorder (VCR) which, using the standard European VCR tape format, features insert and assemble editing, stop motion and dual sound track dubbing.

Satellite helps fight forest fires

One of the oldest threats to life on Earth, forest fires, is now being attacked by the newest of man's tools, space technology. Instruments developed to sense conditions when fires start easily are being teamed with a satellite relay station and computers to give the California Division of Forestry (CDF) a "Fire Index Measurement" from an experimental unmanned remote station in a fire area near Sunol, California.

Foresters say that knowing where fires are probable and how they might act is almost as important as men and equipment actually fighting fires. An unmanned station to establish the fire index in remote areas is doubly important because it gives timely readings which have in the past been made by forestry personnel as only one of their many duties, and it has been a problem for them to get the information to their headquarters by telephone. Important, too, is the idea that when fires occur, forestry personnel are often pulled into firefighting duties and can no longer monitor their areas.

The new system is based on sensors developed by the CDF and NASA's Ames Research Centre at Mountain View, to check wind velocity and direction, air temperature, relative humidity, and fuel moisture content, a measure of the flammability of forest floor litter. Under an agreement between Ames and the Division Forestry, Ames aerospace technologists have joined the CDF instruments with a NASA "black box" which converts their measurements into data which is beamed to the Earth Resources Technology Satellite (ERTS) at least twice a day.

The ERTS, orbiting Earth every 100 minutes some 915 kilometres (540 miles) overhead, picks up the signals with special receiving equipment. The satellite automatically relays the information to a NASA tracking station in the Mojave Desert which passes it along electronically to NASA's Goddard Space Flight Centre in Maryland. The coded data is sorted out by computer and sent to Ames back in California where it is processed by computer and sent to Forestry headquarters in Sacramento, in a useable form. In the Sunol experiment, the fire index information is passed to Sacramento on a daily basis, but it could be made available within an hour after an ERTS pass if need be.

The sensing unit in the Sunol area has been operating successfully for several weeks and the experiment has been termed by the CDF "highly successful."

The success of the project is also sparking interest in the possibility of using the system to monitor air pollution.

Hitachi completes tactile robot

The Hitachi Central Research Laboratory in Tokyo, Japan has completed a tactile industrial robot with a flexible wrist and delicate feeling. The robot can insert pistons in cylinders with a clearance of about 20 microns, faster and more deftly than human hands.

In such inserting operations, it is extremely difficult to set the positions of the two objects to be fitted together, and also the small clearance tends to make the two objects freeze to each other to make insertion impossible. Operations requiring clearances measured in microns have been accordingly considered impossible with conventional industrial robots or automatic assembling machines. Generally only skilled human workers can do such operations, which call for delicate feeling rather than good eyesight.

According to Hitachi, their new "HI-T HAND" Expert 1 has been designed with the delicate feeling necessary for such inserting operations. It comprises a main robot with three degrees of freedom of motion, an auxiliary robot with two degrees of freedom, parts supply equipment and a sequence control device.

In the inserting operation, the hands of the main and auxiliary robots each pick up a cylinder and a piston respectively and seek out the position of the hole in the cylinder. Next, the position of the piston to the hole is fitted and corrections are made in the direction for insertion to prevent freezing.

A demonstration of the capabilities of Hitachi's new tactile robot hand.

The operation is carried out with the aid of tactile sensors that feel out the position of the objects to be fitted. (More than 10 patents pending.)

Computers are not used in the operation; only a simple sequence control device. Hitachi claim this is the first time a robot has been given the delicate feeling of the human hand, making possible the automation of difficult assembling operations in many fields.

Less than 10 seconds is required for the operation from the supply of parts to insertion. Only 3 seconds is necessary for the insertion itself. The sequence of operation with the control device is set by a pin board.

The "HI-T HAND" Expert 1 is scheduled to be announced at the Conference of the Society of Instrument and Control Engineers to be held at Hokkaido University in Japan this month.

Prime Minister opens new STC plant in Sydney

A new $3½ million factory and plant installation for Standard Telephones and Cables Pty Limited at Alexandria, Sydney, was opened recently by the Prime Minister, Mr Whitlam. The new plant, of 150,000 square feet over two floors, was built primarily for the development and manufacture of Metaconta IOC electronic public telephone exchange equipment and electronic Minimat private branch exchange (PABX) equipment.

STC won contracts for the supply and installation of Australia's first three electronic trunk exchanges, valued in excess of $13 million, in open world competition. The first contract, for the new Pitt Street Exchange in Sydney, was followed in 1971 by two further contracts to provide similar equipment for Melbourne and Adelaide. The computer controlled exchanges are designed to handle high usage subscriber trunk dialling facilities, and are claimed to herald a new age in Australian telecommunications.

The Managing Director of STC, Mr A. T. Deegan, said that it was in about 1967 that the Australian Post Office and STC realised that the growth of the trunk network was such that by the early 1970's trunk exchanges would be required in sizes considerably exceeding the economic capacity of the present system.

"Accordingly, we commenced technical discussions with the APO, and following studies of worldwide developments, they were convinced that the correct solution for Australia would be for an electronic system using computer stored program control.

"World wide tenders were called and we were awarded a contract for what is probably one of the world's largest and most advanced trunk exchanges. This is now being installed in the Pitt Street Exchange in Sydney."

NEWS HIGHLIGHTS

200,000 CP from 150W, only 2 cubic inches

An efficient new high-intensity illumination system, based on an exceptionally reliable short-arc xenon lamp, has been developed by Varian Associates of Palo Alto, California. The new lamp measures only two cubic inches but can deliver a peak beam of 200,000 candlepower while consuming only 150 watts.

Varian will market a system that includes the xenon lamp, a power supply and a cooling unit. The company will also design and engineer complete illumination systems to customer specifications, supplying all electrical, mechanical and optical components.

Called the VIX-150, Varian's new xenon lamp is manufactured by the company's Eimac Division. It provides exceptionally consistent, broad-band illumination that spans the UV, visible and IR regions of the spectrum. Wavelength composition of its light is very similar to that of sunlight.

The lamp's efficiency — measured in lumens of output per watt consumed — is three to four times greater than the efficiency of competing designs. Comparable economy has been available hereto-fore only in an earlier Eimac xenon lamp, the X6207.

Varian says that illumination systems using the new lamp will be ideally suited to clinical, laboratory, photographic and manufacturing applications that demand a dependable source of intense light. Earlier Eimac xenon lamps have been used in optical character readers, surgical light coagulators, photo-etching machines and other advanced devices.

Features of the VIX-150 include long-lasting tungsten-alloy electrodes; a parabolic reflector that is cast into the ceramic body

of the lamp; and an output window made from a single sapphire crystal that is thermally matched to the mating metal parts of the lamp.

The VIX-150's unique integrated construction — the lamp body, electrodes, reflector and window are formed into a single pressurised unit — gives the lamp great mechanical stability. Optical alignment is fixed during manufacture and requires no subsequent adjustment by the user. The finished lamp can be used in any position, unlike some earlier xenon illuminators.

Electronic watch uses 2.4MHz crystal

The Omega watch firm in Switzerland has announced the commercial release of the "Megaquartz 2400" watch, claimed to be the first commercial watch to employ a high frequency quartz crystal and thus be able to offer the performance provided by such a crystal.

Earlier electronic watches have used crystals resonating at audio and supersonic frequencies, from 8192Hz to 65,768Hz, and such crystals tend to be both bulky and prone to excessive temperature drift. The new Omega watch uses a crystal oscillating at 2.359296 MHz. The crystal is thus not only much smaller than lower frequency units, but also considerably more stable.

Naturally enough, the use of a much higher oscillator frequency requires more divider stages to produce the pulses required to drive the actual watch movement. To achieve this without increasing the power consumption, Omega have used micropower ICs developed jointly with the US firm Intersil, based in Cupertino, California.

The complete divider system uses a transformer and analog divider system for some of the stages, and delivers pulses at 1Hz to drive the micro-miniature stepping motor actuating the movement. The movement itself is designed to allow adjustment of the hour hand without disturbing the accuracy of the minute and seconds hands, for convenient use by international travellers.

Overall dimensions of the movement are 31 x 25.6 x 6mm. Actual precision under normal conditions of use is claimed to be better than one second per month.

At far left is the new Omega 2400 watch, with its movement shown alongside.

TV receiver for direct satellite broadcasts

A solid state television set which can be used for community viewing in unelectrified villages, and which incorporates the front-end converter required for direct reception from satellites has been designed and developed by the electronics system division of the Indian Department of Space. Initial field tests have been satisfactory, and the set is now being taken through a production run so as to complete the industrial engineering aspects. It is to be used for India's forthcoming satellite instructional television experiment (SITE).

SITE, on which considerable progress has been officially claimed, involves the broadcasting of Indian instructional TV programs to about 5,000 villages in different parts of the country. About 2,000 sets will be of the direct reception type, capable of receiving signals directly from the satellite. The remaining sets will be located in villages around Delhi, Srinagar, Ahmedabad, and Bombay Poona where regular TV transmitters exist or are being set up.

TV signals from the satellite will be received in these cities by earth stations and then relayed by conventional TV transmitters for reception by sets located in the villages around.

The experimental satellite communication earth station ESCES will serve as the prime earth station during the experiment. It will be used for transmitting programme materials to the satellite and for monitoring transmissions and the performance of the spacecraft.

ESCES will also coordinate operations with NASA and with the Indian earth stations to be set up for the experiment. The prime station is being modified for the experiment and the UNDP is providing assistance in the form of components, expertise and fellowship.

—N. Viswanath, New Delhi.

Colour TV, Fortran courses from U.N.S.W.

The Division of Postgraduate Extension Studies at the University of New South Wales is offering two further courses over Radio University, VL2UV, and television University, VITU, commencing in August.

"Colour Television Equipment" is a course designed to present the principles of colour television broadcasting and receiving equipment, and will cover much of the results obtained by the Australian television industry working parties. A basic knowledge of colour television theory to the level of the previous Radio University course will be assumed. The lectures will be by a panel of prominent authorities. Fees for the course are $15, and enrolments should be made by August 10.

"Basic Fortran IV Programming Part 2" follows on from the first course offered on the Fortran IV programming language, and deals with more advanced concepts. The lecturer is Professor J. M. Blatt. The fees for the course are $10, and enrolments should be made before August 8.

Address of the Division is PO Box 1, Kensington, NSW 2033.

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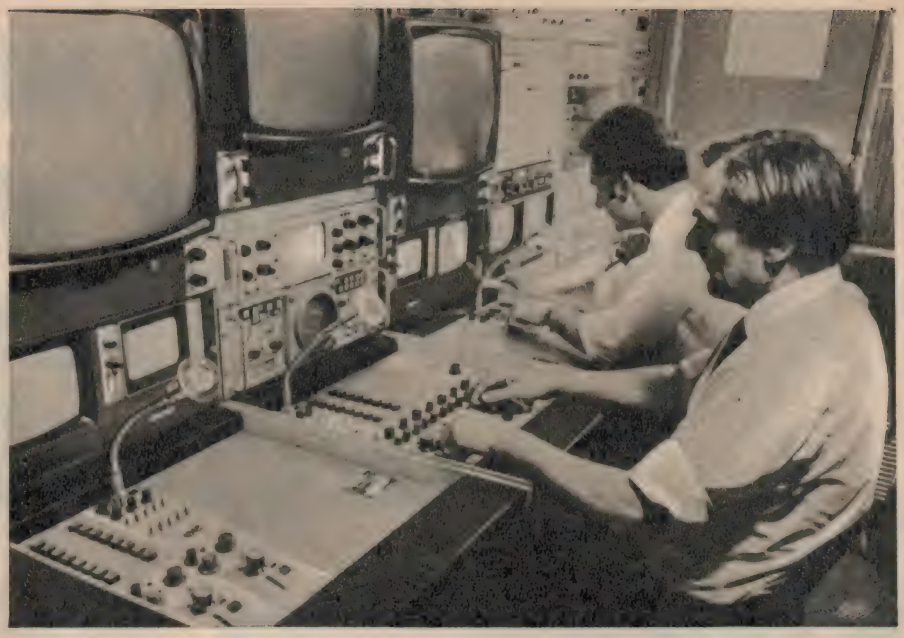
NEWS

Large orders for colour TV equipment

Though colour television is 22 months away, Amalgamated Wireless Aust anticipates its equipment orders in the immediate future will be worth more than $5 million. The company currently holds orders valued at about $2.5 million.

Outside broadcast (OB) vans have been ordered by the Australian Broadcasting Commission, Sydney, Amalgamated Television Services Pty Ltd (ATN-7, Sydney), and Herald-Sun TV Pty Ltd (HSV-7), Melbourne.

The outside broadcasting vehicle for the ABC was designed to meet their requirements and was manufactured in Chelmsford, England, by Marconi Communication Systems Limited. The unit has been delivered to the ABC following extensive acceptance tests at AWA's North Ryde plant. This OB vehicle and those for both ATN7 Sydney, and HSV7 Melbourne, have been designed to meet Australian road regulations; care has also been taken to ensure effective operation in the extremes of Australian temperatures. The custom-built vehicles accommodate up to five Marconi Mark VIII automatic colour cameras, full vision and sound mixing facilities, video tape recorder, off-air and link equipment.



Inside a Marconi colour OB van, of the type ordered from AWA by ATN-7 Sydney and HSV-7 Melbourne.

In addition, AWA has received substantial orders from United Telecasters Sydney Limited (TEN10) for colour television equipment.

Total orders for Marconi Mark VIII colour cameras are in excess of 20. AWA manufactured and supplied to both national and commercial stations more than 100 television transmitters for monochrome operation. These transmitters were basically designed for colour and the Company is now fulfilling large orders for the up-dating of these equipments for colour performance.

New telegraph error correcting system

A new potent error correcting system which, for the first time, raises the reliability of radio teleprinter communication over marine and point-to-point radio circuits to a level suitable for connection to international telegraph networks, has been introduced in the UK by Marconi Communication Systems, a GEC-Marconi Electronics company.

Its introduction is claimed to mark the start of a new era in ship-to-shore communication and to represent one of the most significant operational advances in recent years.

Known as Spector, the new system gives ship, mobile and remote HF radio stations using single frequency working, direct access to fixed telegraph networks, which previously has not been practicable. To accommodate all operational requirements, provision is made for two modes of operation — ARQ (automatic repeat on request) for point-to-point, and FEC (forward error correction) for broadcast traffic. Selective calls can be made in either mode.

First orders have already been placed by the British Post Office for installation in coast radio stations communicating with ships in all parts of the world. Spector is also in production for Marconi Marine, who are supplying the system as part of their wide range of marine electronic equipment.

A major factor which has up to now prevented the replacement of most conventional hand morse circuits by radio teleprinter circuits has been the impossibility of guaranteeing reliable error-free communication without a radio operator. An unprotected HF radio circuit is liable to interference, fading and bursts of static that often mutilate whole sections of a message. Before connecting such a circuit into a public telegraph or telex network, an effective means of error control is required.

Spector, developed to meet CCIR Recommendation 476 (Revised 72), is designed to do just this. In the ARQ mode, on receipt of mutilated characters it will automatically request a repetition of these characters until they are received correctly, ensuring virtual error free communication.

When used in the broadcast mode with forward error correction, the system is capable of detecting, and correcting or indicating most errors.

The ARQ mode is normally preferred for ordinary traffic because the transmitted message will be received at the other end with certainty. Under conditions where the distant radio transmitter cannot be used for ARQ or when the same message must be sent to several stations simultaneously, the broadcast mode provides a means of getting the message across with a minimum of errors.

Apart from making available the obvious advantages of radio teleprinter working in terms of speed and the provision of printed copies, Spector enables a coast station to extend an inland telegraph connection to a similarly equipped station anywhere in the world.

Australia to get "Radio Shack" stores

In recent months Australian electronics enthusiasts, like those overseas, have been hearing mainly bad news about component availability — due to the growing world-wide supply problem. But it looks as if there is at least some good news for local electronics and hi-fi fans: the big US Tandy Corporation has announced plans to set up a chain of its well-known "Radio Shack" stores in Australia.

With over 2,400 stores spread throughout all 50 states of the USA, Tandy Corporation is the largest chain of electronics and hi-fi stores in that country — possibly in the world. They are currently expanding into both Europe and the UK, in addition to the Pacific area. The ultimate plan is to establish about 100 stores in Australia, according to Senior Vice-President Mr Dean Lawrence, who is responsible for the Pacific operation.

Local stores will probably be established on a franchising basis, Mr Lawrence explained. The aim is to employ the highest possible proportion of local people in the organisation.

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SPECIAL WITH KITS THIS MONTH

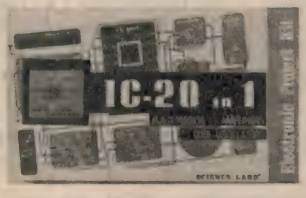
FREE copy of NEW 'BASIC ELECTRONICS'

This 100 page book has only just come off Electronics Australia's press. It's an excellent follow-on book to any of the kits described here, gives a basic, easy to understand insight into electronics covering radio, t.v. etc. Crammed with illustrations, diagrams etc and normally sells for $2. This month we're giving it away FREE with any of these kits. Yes a $2 book for nothing with every kit.

10 in 1 kit

The beaut thing about this one is that you don't need to know a thing about electronics to build radios, amplifiers and oscillator circuits. Ten of them are described, teaching the principles with actual working circuits: 4 radios, a transmitter type circuit and 5 different oscillators. A variety of applications are also covered. Very simple you don't need a soldering iron, a clever spring-grip terminal is used with pre-cut and stripped wires and each terminal is numbered for easy connection. The 20 page booklet tells you how each circuit works and about the parts which include a solar cell, ferrite bar antenna earphone, transformer etc. Some of the circuits can be run from the solar cell but a 1.5V battery (14c extra) is advisable. The kit measures 15"x10½"x2" and costs $8.95 (P&P 50c) and you get the ideal follow-up book FREE, 'Basic Electronics'.

IC 20 in 1 kit



This kit features a specially designed, enlarged integrated circuit (IC) with the top taken off so you can see, just as if you were looking through a powerful microscope, how the capacitor, two resistors, a transistor and diode are placed. Then there are 20 fascinating experiments using the IC. The kit uses an ingenious see-thru printed circuit idea. The components are mounted on a clear plastic sheet and you simply put the circuit you want to build underneath. You can then see where to run the wires to make the circuit work. No soldering thanks to the clever spring-grip terminals. There's a solar battery, ferrite antenna, speaker and earphone and various other components. You can build 1 and 2 transistor radios, a photo burglar alarm, a light frequency controlled oscillator, an electronic machine gun generator etc. Really educational and will give many hours enjoyment. Circuits can be built over and over again. A 9V battery is needed with this kit (53c extra) $13.25 (P&P 75c) including FREE $2 'Basic Electronics'.

150 in 1 The Ultimate kit

How else could we describe this truly magnificent kit which comes complete in a wooden presentation case? The 88 page manual describes 150, yes one hundred and fifty, experiments. No soldering and the kit operates off safe battery supply. An enlarged IC is included (see IC kit above). Kit includes CdS cell, solar battery, d.c. microammeter, speaker, relay, microphone, radio tuner, transformers, two transistors plus IC, potentiometer, slide switch, 15 resistors, 10 capacitors, morse key etc. Projects include Sensitive galvanometer with IC amplifier, ultra low frequency pulse generator, logic circuits, transistorised voltmeter, IC signal tracer, flickering lamp rainfall indicator, tachometer, garage door transmitter and receiver, electronic harmonica, bongo, physiotherapy shocker, wireless IC burglar alarm. The list goes on and on. Case measures 16"x8½"x3½" $35.95 (P&P $2) You'll need a 9V and 2 3V batteries also (85c extra) Dick also gives you FREE 'Basic Electronics' the next step . . .

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The Era of Total Communications...

Here is the second and final part of our correspondent Gene Gregory's report on the way Japan appears to be leading the world in the "era of total communications". Following on from the first part published last month, he deals here with new telephone technology and developments in optical communications.

JAPANESE COMMUNICATIONS technology in other countries: a satellite communications earth station in New Zealand, built by NEC.

In the final analysis, Japan's "Total Communications" revolution depends on a variety of specific advances that will make both transmission and switching equipment less expensive. Since the cost of transmission goes down the more signals that are sent over a given path, the development of two new systems in Japan have critical importance for the development of an integrated communications network: pulse code modulation (PCM) transmission system and thc electronic exchange (DEX). The PCM system, highly flexible in nature, provides hybrid transmission of television, videophone, facsimile and data signals without any one set of signals interfering with the others, while high-capacity, high speed electronic switching systems are needed for low cost handling of integrated telephone, data and video systems.

Along with the recent development of the semiconductor industry, the practical use of a sufficiently economical PCM system as a short haul carrier system became feasible. In 1965, the 24-channel PCM system for short trunks was first introduced in Japan. Since exchange offices on toll trunk circuits have been transformed to subscriber toll dialing at a very high speed, the demand for the number of short haul toll trunk circuits has increased remarkably in recent years. But the congestion of cables in underground conduits makes new telecommunications installations in large cities extremely difficult, so that the economical multiplexing of local exchange trunks without requiring underground conduit extension becomes a most important consideration in the expansion or modernisation of existing circuits.

The PCM-24 system meets the requirements for a multiplex system that is at once more economical than conventional carrier systems and capable of being used for still shorter haul toll circuits as a TDM-PCM system. It can be used for all kinds of toll trunks and local exchange trunks by attaching the appropriate trunk relay set, and is easily adaptable for both 2-wire and 4-wire purposes. And, in addition to its advantages as a general telephone circuit, the system can be used for 24-channel 50-baud carrier telegraph or 1,200-baud high speed data transmission.

Since the 24-channel PCM transmission was introduced in 1965, the rapid increase in demand on the system has led to the development of higher capacity PCM systems. A microwave and a pair cable system was developed with a capacity of 240

Part 2

LEADING MANUFACTURER of microwave and satellite communications systems in Japan is Nippon Electric Company (NEC). Shown is their Yokohama plant.

channels and a bit rate of 16 Mb / sec. More recently, to meet the needs of an expanded system and the high flexibility of hybrid transmission, a 100 Mb / sec system is being developed together with a new type pair cable with improved crosstalk characteristics which will give high flexibility in network planning.

By using pair construction instead of quad, an appropriate combination of stranding pitches of pairs and shielding tape between layers of pairs, a decrease in crosstalk as well as attenuation has been achieved at higher frequencies. Far-end cross-talk on the new cable is reduced more than 10dB compared to cables now in service. The unit construction and unit shield reduce near-end crosstalk and facilitate two-way transmission on a single cable, using both its units.

The PCM signal is obtained either by multiplexing 12 8Mb / sec (120CH) signals of PCM-16M systems, or by coding a TV signal or an FDM super-master group signal by the highspeed coder of this system. For the trunk circuit, PCM systems with speeds of 400-800 Mb / sec are now being developed. The coaxial system and the millimetric waveguide system have a capacity of 800 Mb / sec at a clock frequency of 400 MHz with 4-phase PSK modulation, while a microwave system in the upper band of SHF has a capacity of 400 Mb / sec at a clock frequency of 200 MHz. In these systems four PCM-100M signals are multiplexed and transmitted.

Transmission tests on these systems have been successful, using prototype equipment, including a 100-400 Mb / sec multiplexer, and regenerative repeaters of cable, millimetric, and microwave systems. By using these high-capacity systems in trunk circuit and the PCM-100M system for transmission in short haul links, a flexible integrated network for video, voice and data signal transmission will be developed.

Millimetric waveguide systems, which transmit wideband signals at a notably low attenuation by using the TE10 mode, are now being developed to provide the trunk circuit for integrated communications networks. Because of their extremely high capacity for transmitting video and data signals, millimetric waveguide systems decrease the bandwidth unit transmission costs. Since the cost of transmission goes down by increasing the number of signals sent on a given path, accomplished by providing transmission paths of greater bandwidth, the new system provides the solid economic foundations for the information revolution.

The original prototype of this system used pulse code modulation-binary pulse amplitude modulation (PCM-PAM) at a clock frequency of 225.47MHz, corresponding to a capacity of 3,000 telephone channels or the equivalent. To increase the total channel capacity, a new prototype has been developed using a four-phase modulation with a clock frequency of 403.04 MHz, producing a transmission rate of about 800 Mb / sec, corresponding to a capacity of 12,000 channels in a radio system and 300,000 channels by a waveguide line.

Improvements were made primarily in the modulator-demodulator and clock circuits, as well as in various other circuits at millimetric frequencies. The modulator consists of a pi / 4 radian sinusoidal phase modulator and a pair of Schottky diode switches to select two stripline paths, with a phase difference of pi radians. To reduce unfavourable reflections in the modulator circuit, input circuits with the baseband pulse and an IF of 4GHz were carefully designed by constructing a branch filter for these frequencies. The time interval in which the modulator rises and falls is 0.7ns, with a modulation loss of less than 1.6dB and a phase error of less than 3 deg. Each of the two differential demodulators consists of a Schottky barrier diode phase comparator and an Esaki diode pair decision circuit, connected at very short distances to reduce the effect of reflections. Regions of uncertainty are less than ± 5 deg and 0.3ns for phase and time respectively.

By offsetting the transmitter local frequency of 50MHz and by the sinusoidal phase modulation of pi / 4 radian peak at the clock frequency, a steplike phase modulation of pi / 4 radian is added for each clock period. The operation facilitates clock timing extraction in the receiver by enabling use of a single detector circuit in the IF stage. To reduce the clock phase instability arising from signal strength variations, a wideband limiter with very small phase variation was obtained by giving an appropriate bias to microwave transistors. The phase variation of 400 MHz was less than 4 degrees for an input variation of 30dB. The modulator-demodulator error rate characteristic through the IF was very close to the theoretical figure.

The local power at millimetric frequencies is generated by GaAs frequency multiplier diodes excited by an X band IMPATT diode oscillator. The oscillator is stabilised by injection locking of a quality crystal oscillator output. For the transmission, a converter employing a germanium avalanche diode gives an output of 1.6mW. The receiving mixer is a GaAs Schottky barrier diode with an overall noise figure of less than 13dB. A repeater overall gain of 50dB is obtained at a transmission error rate of 5 x 10 to the minus 9. The repeater system, composed only of solid state devices, uses repeaters at the carrier frequencies of 47 and 50 GHz.

Pending perfection of this system, however, NTT has begun work on a submarine cable system, with a nominal 200 MHz bandwidth, to handle the concentrated demand for communications services along the Pacific coast of central Honshu. The cable will accommodate about 25,000 telephone channels, or the equivalent in television, data, videophone and other services, when it becomes operational between 1975 and 1977. This system, which will supplement the present 4 and 6GHz micro-wave relay systems which now constitute the backbone of Japan's long line network, will be relatively easier to install and maintain than coaxial cables in densely populated urban areas.

Efforts to develop an integrated electronic switching system for the rapidly expanding transmission network, begun in 1964 as a joint effort of Japanese manufacturers and NTT, produced a prototype (DEX-1) of a large-sized electronic switching system in 1966. Based on this experience model DEX-2, designed for commercial use, was built in 1969 and field-tested in a commercial exchange station. This model uses miniaturised crossbar switches as the speech path switches, and is operated by a control program stored in its metal card read-only memory with a capacity of 65 kilowords of 33 bits.

The crossbar switches have two 8 x 8 wire crosspoint contacts each, operated by a self-holding mechanism, resulting in low power dissipation and economical construction. Two of the 4 stages of the crossbar switches are composed of a line-link network and a trunk-link network, each of which has 1024 junctions. On each 1.3m-wide frame rack,

512 crossbar switches can be mounted, and 4 racks compose a network of 8,192 terminals. The 8,192 subscriber terminals are scanned by a group of 4,096 relays, and the 1,024 trunk terminals by 2,048 relays.

The central control equipment is composed of 5,500 integrated circuits and is similar to an ordinary digital computer, except for features such as efficiency in performing bit-by-bit processing and an extremely high reliability in continuous operation for a long time. Equipped with magnetic drum and tape low-speed storage systems, the central control unit can be connected to ordinary input or output terminal equipment as well as to communications control equipment for common wire signalling.

Since its installation DEX-2 has operated successfully while development work on an improved model, DEX-21, has been progressing. In the new model, miniaturised crossbar switches one-eighth the size of standard crossbar switches are used. The trunk relays have self-holding mechanisms, substantially reducing power dissipation, and the storage systems of DEX-21 further add to its overall economy using high-speed cores with a cycle time of 1.4 us and a common back-up storage not completely duplicated. Instead of the read-only memory of DEX-2, a semi-permanent memory using permalloy plated wires is used, facilitating easy modification of control information, despite the high stability of stored information. Moreover, four storage modules with a total capacity of 1,080 kilobits can be mounted on a rack, at a cost which is less than 60 percent of a core storage system of the same capacity.

A high-capacity magnetic drum storage with floating heads has also been developed for use in this system, as well as in the centralized storage. The drum has a capacity of 37 megabits and a speed of 3,000 rpm. This extremely high bit density resulted, in turn, in reduced size and weight, one-fifth of the conventional drum.

If all goes according to plan, a local exchange system using the DEX-21 will be put into commercial use this year and a toll exchange will follow. Together with medium- to small-sized electronic switching systems being developed as remote-control systems, the DEX-21 will provide the necessary switching facilities for telephone, videophone and data services scheduled for expansion or inauguration in the coming year. The high processing speed combined with the high flexibility of the central control of the DEX-21 system, together with the extremely wide frequency range of the compact crossbar speech path switches are expected to provide efficient and economical exchange facilities for the integrated communications system.

Meanwhile, the next stage in the development of Japan's communications revolution has already been set. Nippon Electric Company has successfully developed and put into commercial application laser communications equipment using the He-Ne gas laser. The new laser transmission has a capacity of 1,000 Mb / sec, obtained with the use of high-speed PCM technology and a newly developed high-performance and high-speed light modulator together with a long-life, stabilised and compact laser oscillator. With a maximum range of 3 kilometres, longer distance communications is achieved by installing the same type of transmitting and receiving equipment as relays. This equipment can be used for a wide variety and volume of communications needs, being well-adapted to television, videophone, data, facsimile, and telephone. In addition, it is uniquely adapted for use in cities where the use of microwave and installation of cables is unsatisfactory or costly.

Based upon success with He-Ne gas laser data transmission in 1969, MITI's Electrotechnical Laboratories have also developed PCM-PAM data transmission over a 1.8 kilometre distance using a carbon dioxide gas laser. With speeds of 1.544 Mb / sec and a 1 in 100,000,000 error rate, the system would be quite satisfactory for use with computers. ETL scientists, now engaged in perfecting the stability of the beam, believe that the carbon dioxide gas laser will be suitable for short-haul computer online systems, and for time-sharing systems.

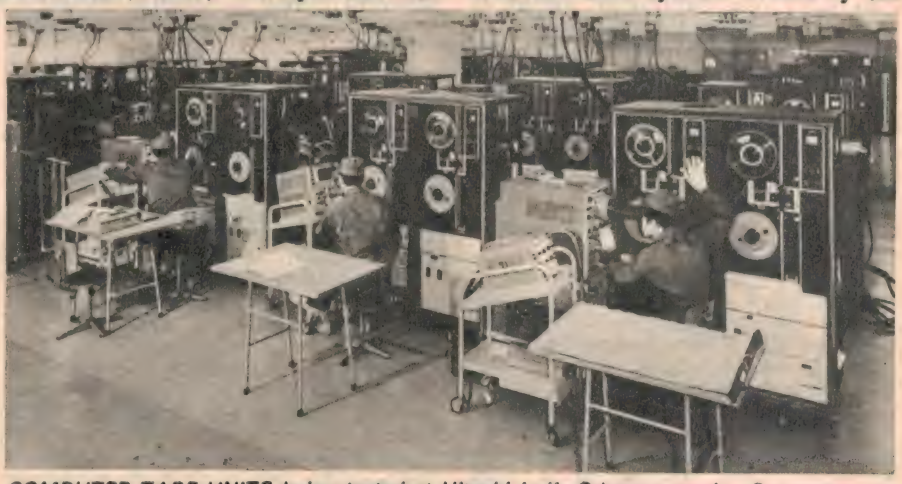
Still another innovation in laser communications has emerged from the NEC laboratories, where, in co-operation with Nippon Sheet Glass, the SELFOC laser and SELFOC laser guide have been perfected. The SELFOC glass laser provides continuous and stabilised oscillation and amplification and the SELFOC glass fibre, in which the refractive index becomes smaller from the centre to the perimeter, serves as a vastly improved laser beam transmission guide permitting the beam to be bent or turned.

Most important of the SELFOC laser features is the continuous generation of super short light pulses, making possible the transmission of 1,000 TV channels or 10,000 videophone channels. When used for telecommunications, super high speed transmission can be achieved, while as an economical solid state laser oscillator with continuous output of only a few watts, the SELFOC laser can be used for medical treatment and measurement.

But before it can be applied practically in telecommunications, two critical problems must be solved: loss in transmission must be reduced and ways must be found to lengthen the transmission line. During recent tests transmission loss has been reduced to 100-300 dB / km using red colour lights with 0.63 micron wavelength, and when an infrared ray is used with 0.84 micron wavelength, the loss was halved to 50-150 dB / km. At the same time, the transmission guide has been extended to 20 metres, which is still only a fraction of what will be necessary if the SELFOC laser is to become functional.

Telecommunications will be to Japan's incipient "information revolution" what highways and the automobile were to the industrial revolution. With the expanded use of CATV, videophone, facsimile and data communications the whole pattern of work, education and entertainment will change — providing vast new opportunities for electronics equipment, service and software industries. New communications technology will serve as the basis for the entire redistribution of Japanese population and industry, improve urban life and reduce transportation problems.

Given these possibilities, broadband telecommunications will develop into a multi-billion dollar business with enormous profit possibilities for manufacturers of transmission and switching equipment, computers and other central processing equipment, and terminal equipment. For the consumer electronics industry, total communications systems needed by the new information society open vast new horizons with a vast range of consumer needs to be met.



COMPUTER TAPE UNITS being tested at Hitachi Ltd's Odawara works. Computers are increasingly being used for communications system control.

The massive effort required to bring together seemingly unrelated technologies and devices will be a major preoccupation of Japanese industry for the remainder of the Twentieth Century. Japan is uniquely equipped for this task. Indeed, it is the only country in the world which seems to have prepared itself organisationally, technologically, industrially and psychologically for entrance into a technetronic age in which information provides the central dynamic force of society as a whole, and its economic and political activities in particular.

As a result, for the first time in modern history, all available evidence indicates that during the remainder of this decade Japan will lead the world in the introduction of high technology — in much the same way it pioneered the production of transistor radios, transistor TV, and solid state calculators during the 1960s. With the combined impetus of advanced technology and a well-organised, dynamic telecommunication service network, the Japanese market for exotic telecommunications products is expected to keep pace with that

(Continued on page 125)

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Building effective compact speaker systems requires technical *"know-how"* and *experience* — and that's where Wharfedale really shines. For over forty years Wharfedale has been Britain's leading manufacturer of high quality wide range loudspeakers; Wharfedale advances in technology are very obvious in the all-new "Denton" and "Linton".

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Now examine closely these brief specifications:

DENTON 2.
Size: 14" x 9¾" x 8¾"./Frequency response: 60-16,000 Hz. ± 3 dB./Power rating: 20 watts DIN./Speaker complement: 8" bass speaker, 2" tweeter./Crossover frequency: 1,400 Hz./Finish: Oiled teak or polished walnut.

LINTON 2.
Size: 19" x 10" x 9½"./Frequency response: 55-17,000 Hz. ± 3 dB./Power rating: 20 watts DIN./Speaker complement: 8" bass, 2" tweeter./Crossover frequency: 1,200 Hz./Finish: Oiled teak or polished walnut.

LINTON 3.
Size: 19" x 10" x 9½"./Frequency response: 55-17,000 Hz. ± 3 dB./Power rating: 25 watts DIN./Speaker complement: 8" bass, 4" mid-range, 2" tweeter./Crossover frequencies: 1,100 and 4,000 Hz./Finish: Oiled teak or polished walnut.

DENTON 3.
Size: 14" x 9¾" x 8¾"./Frequency response: 65-17,000 Hz. ± 3 dB./Power rating: 25 watts DIN./Speaker complement: 8" bass, 4" mid-range, 2" tweeter./Crossover frequencies: 1,100 and 4,000 Hz./Finish: Oiled teak or polished walnut.

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SG-WNP-4

Lee de Forest: idealistic "Father of

This month is the centenary of the birth of Dr Lee de Forest, the great American electronics pioneer and entrepreneur often called the "father of radio". As a timely tribute to the man, we are happy to present this summary of his life and its many achievements in the fields of radio, television, talking pictures, radar and diathermy.

by GEOFFREY MASLEN

The "father of radio" was born one hundred years ago this month. He was Lee de Forest, born in Council Bluffs, Iowa, on August 26, 1873. Like Edison and Tesla, he was one of the last of the individualistic inventors, now virtually eliminated by the advent of the large research laboratories.

While credited with more than 300 American and foreign patents, the name de Forest is largely connected with but one magic word — audion, first of the line of multi-electrode valves. In inventing the triode valve in 1906, de Forest took the most important single step in the whole development of radio communication. Indeed, the transition from wireless to broadcasting would not have been practicable without the development of this valve, variously described as the "cinderella of electrical science," "the magic lamp of radio," "the truest 'little giant' in all history," and "the greatest invention since fire, the lever and the wheel."

De Forest lived to see a multi-billion dollar electronics industry employing more than a million people in the US alone, grow from the audion tube. But he also took an active part in the development of radar, television, sound measurements, electric phonographs, and diathermy machines. He recounted in his autobiography, "The Father of Radio," published in 1950, a story of four marriages, and the loss of four fortunes before gaining contentment. He was considered to be a genius in the field of communications; the New York Times described him as "a great dreamer, a poet, and an enthusiastic advocate of radio and television for educating the masses."

De Forest was the son of Henry Swift de Forest, a minister who early in Lee's boyhod became president of Talladega College, Alabama — 'founded to educate and uplift negroes." Because of his father's involvement with the blacks, Lee was shunned by other white boys. Left alone, he became interested in experimenting with crude tools. He designed a new farm gate, built a locomotive out of pine boards and barrels, constructed his own electric motor, and at 15 proudly announced he had discovered the secret of perpetual motion.

Despite these interests, Lee's father wanted him to study the classics in preparation for the ministry. Lee put an end to these hopes after he entered Mt Hermon Preparatory School in 1891. He wrote to his father: "Dear Sir, I intend to be a machinist and inventor because I have a great talent in that direction." That was the end of the controversy, and Lee went on to the Sheffield Scientific School at Yale in 1893, where he enrolled in the first course in electricity to be offered in any American college.

At Yale he spent his time studying, reading works on electricity, and inventing — one invention at the time was the design for an underground trolley! After receiving his PhB in 1896, he stayed on at Yale for graduate work, eventually completing the research on the "Reflection of Short Hertzian Waves from the Ends of Parallel Wires" which won him his PhD in 1899.

That year was shortly after Marconi had taken out his first patent on wireless telegraphy, and young de Forest, penniless but ambitious, decided to devote his life to research on wireless. With a borrowed $50 he set out for Chicago and there started work as a labourer in the dynamo factory of the Western Electric Company. A little later he was promoted to the telephone laboratory. Every spare moment he could find he spent developing a device for detecting wireless signals, and early in his research discovered that he could use a telephone receiver as an indicating device in receiving wireless signals.

DE FOREST'S AUDION, the first triode valve, which he developed in 1906. Without it, the development of radio and electronics might have been delayed for decades.

After his discovery in 1900 he left Chicago and settled in a shack in Milwaukee with a Professor Johnson, who was doing some experiments of his own on wireless sets. De Forest refused to give him his own anti-coherer idea — and found himself fired.

De Forest returned to Chicago where he obtained one position on the staff of an electrical magazine, and another teaching.

He continued working on his detector, which he called a "sponder," until 1901 when he gave it its first long distance test — and discovered that it worked! The sponder, a kind of electrolytic detector, made possible the use of headphones for wireless messages. It was de Forest's first patent and it made him a close competitor of Marconi. Immediately, he and a partner, Edwin Smythe, decided to go ahead with the marketing of the device, only to discover that money and publicity were necessary.

To get publicity, de Forest persuaded the Publishers' Press to let him report the International Yacht Races with his wireless in competition with Marconi operators, who were doing this for Associated Press. De Forest's broadcast was a complete failure, but so was that of his rivals. However the publicity was successful and encouraged by it, de Forest set up a machine shop and erected the first wireless station of its kind in Jersey City.

Eventually, de Forest was able to interest Wall Street sufficiently to form the De Forest Wireless Telegraph Company, and with the money from the capitalisation bought equipment and set up transmitting rooms. In 1903 he went to England to demonstrate his invention and while there communicated by wireless from Wales to Ireland.

Back in the United States, shortly afterwards, he was awarded gold medals at the St Louis World's Fair in 1904 — the first of many — for his work on wireless telegraphy. Then he began to give up the wireless field, partly because his electrolytic detector had been declared to interfere with the patents of another inventor, but mostly because he was particularly interested in transmitting the human voice.

Returning from a third voyage to England in 1906, de Forest found his company in financial difficulties and with the other directors anxious for him to resign. He accepted a few hundred dollars offered him and set out on his own again. "I'll build a

Radio"

better detector for wireless reception," he announced. "I'll try to send the human voice through the air instead of messages by dots and dashes."

Earlier, in 1904 J. A. Fleming, Professor of Electrical Engineering at University College, London, had experimented with the first thermionic two electrode valve or diode. The full significance of Fleming's experiments was not appreciated at the time, and it was Lee de Forest, who by inserting a third electrode into Fleming's valve, thereby making it a triode, took the most important single step in the whole development of radio communication. Yet, the full significance of de Forest's invention was not realised either, and the two inventors quarrelled about British and American patents instead of exploring the revolutionary implications of their discovery.

The multi-electrode valve enabled much more sensitive wireless receivers to be made and permitted radio-telephone messages to be picked up at far greater distances than had previously been thought possible. It was applicable at one and the same time both to transmitting and receiving circuits. It contained within itself all the potential force of broadcasting. But the triode, like a great many of de Forest's inventions was the subject of a long, drawn-out court battle, in litigation with the Marconi Company. The court held that the origin of the audion could be traced directly to the Fleming valve.

De Forest insisted that he had invented the audion independently of Fleming and that therefore, it was an injustice to him to be credited "only with having added a third element to the Fleming valve and calling the completed bulb an audion." "I worked along entirely original lines," de Forest said, "finally arriving at the three element tube as the result of step-by-step progress."

Immediately after the invention of his triode valve, Lee formed the De Forest Radio Telephone Company to promote his idea and by the end of the year, after a public trial of radio-telephone apparatus, the US Navy Department ordered enough radiophone sets to equip the fleet.

Not only was 1906 a watershed in the history of broadcasting, it was also the year in which de Forest married Miss Lucille Sheardown, after the first "radio courtship" in history. He had installed a wireless apparatus in her home, and being a shy young man, he proposed from a safe distance through the instrument. He was accepted in the same way. Unfortunately, the distance which separated the young couple at the proposal seems never to have been overcome, because the following year the marriage was annulled!

DR DE FOREST HIMSELF, in his 85th year. This picture was taken late in 1958 when he visited a Hollywood film studio as an honoured guest.

In 1908, de Forest married Nora Stanton Blatch and went with his bride to Paris to install one of his radio telephone transmitters on top of the Eiffel Tower. Back from his honeymoon, he built an aerial on top of the New York Metropolitan Life Insurance building and shortly afterwards installed microphones in the Metropolitan Opera House. It was via these on January 2, 1910, that the voice of Enrico Caruso singing at the opening night of the opera "Cavaleria Rusticana" was transmitted in the first radio broadcast of its kind.

"This transmission of the voice of Caruso," the inventor said years later, "was the first broadcasting of music other than phonograph selections. Although only a few amateurs and ship operators had heard the great singer's voice, we knew it had been a success."

De Forest became short of funds again — he was never a success as a business man — and went out to San Francisco as a research engineer for the Federal Telegraph Company, while his own company slowly died. In 1914 he refinanced it with $50,000 he received from the sale of his audion tubes to the American Telephone and Telegraph

Company. This occurred after he had left San Francisco for New York again. Then he set up another laboratory, and later a transmitter at the World Tower Building from which regular radio broadcasts of vaudeville were given for the first time. In 1916 he transmitted the first radio broadcast of presidential election results.

As radio developed de Forest was manufacturing radio tubes for the new industry, but his heart wasn't in this work. He was looking ahead even further — toward the development of talking motion pictures. By 1923 he had shown for the first time a sound-on-film program in the Rivoli Theatre in New York, and had invented his "noiseless recording" positive prints and "glow light" recording of sound on films. The motion picture producers weren't interested, though — until 1927, when Warner Brothers plunged into the field, four years after de Forest had demonstrated the practicalities of talking pictures.

From talking pictures de Forest turned later to television and from television to its application in "television torpedo planes," predating by some 20 years the advent of the military satellite. Meanwhile, in 1934, after years of litigation with Edwin Armstrong, his claim to the invention of the "feed-back" and oscillating vacuum tube circuits had been upheld by the US Supreme Court. Yet despite recognition from learned societies, manufacturers and scientists, de Forest never made money and by 1937 he had filed a bankruptcy petition listing assets of $390 and liabilities of $104,000.

By 1934 he founded the Lee De Forest Laboratories, devoted chiefly to research and manufacture in the new field of short wave, or radio, diathermy: the application of high frequency currents to heating human tissues. This was believed to be beneficial in cases where congestion was involved. The US Army and Navy once used large numbers of de Forest Dynatherms in hospitals and on all battleships.

With the widespread development of commercial radio during and after the Second World War, de Forest became more and more concerned by the way his "child" was being used by the advertising industry. He wrote an open letter to the National Association of Broadcasters at a meeting in Chicago in 1946, a letter whose condemnation might equally apply to parts of Australian radio today:

SMILING DE FOREST reads news of patent infringement decision in his favour, in March 1930. De Forest had taken action against the Stanley Company of America for their use of a motion picture sound recording method.

"What have you gentlemen done with my child?" de Forest asked. "You have sent him out in the streets in rags of ragtime, tatters of jive and boogie-woogie, to collect money from all and sundry for hubba hubba and audio jitterbug. You have made of him a laughing stock to intelligence, surely a stench in the nostrils of the gods of the ionosphere; you have cut time into tiny segments called spots — more rightly stains — wherewith the occasional fine program is periodically smeared with impudent insistence to buy and try."

Despite such occasional outbursts, de Forest removed himself pretty thoroughly from the public eye to the cloistered retreat of his laboratory in Los Angeles, where he spent many hours working on a terrain altimeter, patented in 1946; diathermy machines; and in 1948 a television device for the transmission of colours! (In 1949, however, de Forest told the Federal Communications Commission that no major colour television systems were ready for commercial use.)

He was now renowned and respected. Two radio schools paid him retainers for the glamour of his name; in 1947 he was in Chicago directing veterans' training at American Television Inc; in 1951 he became vice-president of the National Association for Better Radio and Television; former President Herbert Hoover addressed a dinner in his honour at the Waldorf-Astoria Hotel in April, 1952. And despite his advancing years, de Forest continued working at the same intense pace. In 1957, in his 84th year, he received a patent on an automatic dialling device for telephones! A year later he received an award from the National Association of Broadcasters — those whom he had attacked six years earlier — for his contribution as the originator of modern electronics.

Even 45 years after the historic broadcast of Caruso's voice — right up until the time of his death in July, 1961 — de Forest lived life at a feverish pitch. And always he struggled to keep radio and television as instruments of education and culture.

"Throughout my long career," he said, "I have lost no opportunity to cry out in earnest against the crass commercialism, the heretic vandalism of the vulgar hucksters, agencies, advertisers, station owners — all, who lacking awareness of their grand opportunities and moral responsibilities to make of radio an uplifting influence, continue to enslave and sell for quick cash the grandest medium which has yet been given to man to help upwards his struggling spirit . . ."

AWA TO DEVELOP INTERSCAN SYSTEM

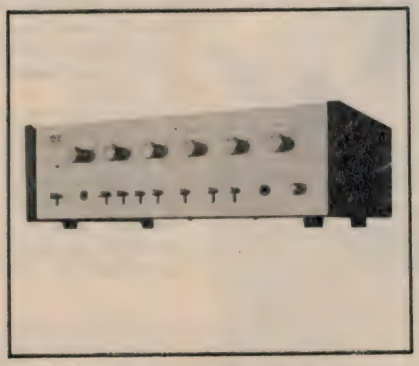
The development contract for an evaluation version of the new CSIRO-developed microwave landing system for aircraft, INTERSCAN, has been placed by the Department of Civil Aviation with Amalgamated Wireless (Australasia) Ltd. The equipment, which will be developed from the concepts and with the guidance of the Department of Civil Aviation and CSIRO, will be installed during 1974 at an Australian airport and evaluated by DCA, which will compile a final report for consideration by (ICAO) International Civil Aviation Organisation. Countries other than Australia are working on alternative approaches to the common operational problems, and will also make submissions.

AWA engineers, with the support of sub-contractors, will construct a total of four microwave ground antennae complete with transmitters and associated control synchronising equipment. Two sets of airborn equipment for both main airline and general aviation (light) aircraft will be supplied together with monitoring and test facilities.

A detailed study will be completed within the next four months during which precise objectives will be established and appropriate procedures will be planned to enable construction to be completed within the time-scale.

A clear picture on distortion

Suppose you're listening to the Berlin Philharmonic performing Beethoven's Ninth through an ordinary amplifier. Chances are you're hearing sounds that neither Ludwig nor the Philharmonic intended. And what's the point of buying expensive records if your amplifier is giving inferior performance? The aim is to achieve a replica or mirror image of the original. And to do that you've got to eliminate distortion. That's what AKAI have achieved with their **AA-5500 AMPLIFIER.** Distortion is actually less than 0.1%! AKAI did it with SEPPOTL circuitry: To eliminate the main cause of distortion. Result? Amazingly clear and distortion-free reproduction. We could go on quite a bit about the AA-5500's sensational tonal control, excellent signal to noise ratio, elimination of turntable rumble etc. but your AKAI dealer has all the facts. Have a listen and judge for yourself.



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AK58P

Computer delivers the newspapers

. . . with a little help from its friends

It probably had to happen sooner or later, with labour costs rising higher and higher while minicomputers are becoming cheaper and cheaper: by mounting a minicomputer in a newspaper delivery truck, a US firm has made even the humble paper-boy redundant!

by GEORGE E. TOLES

Using a little editorial license, a newspaper in Fort Worth, Texas, could easily carry a front page story telling its subscribers that "this newspaper is brought to your home via a minicomputer system."

While that may not be literally true, a minicomputer is certainly at the heart of a new Automated Newspaper Delivery System that unerringly directs the delivery of the paper to many of its readers every day of the week, rain or shine.

Developed and produced by Avcon Inc, of Fort Worth, the ANDS guides a delivery truck along a complex route and tells two men mounted on either side of a specially designed vehicle when to throw their papers. And they never miss, according to the Avcon people.

Incorporating a "Naked Mini 16" minicomputer built by Computer Automation Inc, of Irvine, California, the Avcon system effectively demonstrates the broad spectrum of applications areas opened by the advent of such low-cost, parcel-sized computing devices.

The Avcon system is a completely self-contained, on-board system which directs the operation of the newspaper truck and controls its deliveries. It does not require special transponders or electronic signalling devices to be installed at strategic locations along the route.

In effect, the system continuously measures the vehicle's location in relation to a pre-planned route, then issues audio and visual instructions which guide the driver and the paper throwers on their appointed rounds.

The system even activates the vehicle's turn signals shortly before it is scheduled to make a turn, to give the driver added advance warning of the impending manoeuvre. For good measure, the system also detects driver errors and immediately prescribes appropriate corrective actions, according to Robert T. Rapp, Avcon vice president for marketing.

Because of the system's unique guidance capabilities, neither the driver nor the throwers need to be armed with maps, subscriber lists, or prior knowledge of the route. It's all done by tape and computer memory.

All of the system hardware apart from the driver's display panel is mounted in a special installation above the truck's windshield. The driver's display panel is mounted atop the dashboard, so that he can easily read his directions.

The system includes the miniature Naked Mini digital processing and logic unit (it has 4k / 16-bit words of core memory); a tape cartridge drive, proprietary sensing devices, control / display console with message printer, and a variety of annunciator and actuator devices.

The mini computer mounted on the rack is programmed to analyse the output of speed and direction sensors developed by Avcon. The mini computes the path of the vehicle and compares it with a route "signature" recorded on the tape cartridge. It then issues instructions and commands, as required.

Here's how it works: First, a fixed route is divided into segments and a "signature" for each segment is recorded by driving over the segment with the Avcon system operating in its mapping mode. Locations of delivery points are recorded when the driver or an assistant depresses a switch at each location. These locations are sited in

SPECIALLY-DESIGNED newspaper truck in Fort Worth, Texas uses an on-board mini computer to direct the driver along the delivery route. It also tells the throwers when to launch their missiles.

CONSOLE in the driver's cab gives him explicit instructions regarding his route. The minicomputer controlling the system also sounds an alarm if the driver makes a mistake, then tells him how to correct matters.

terms of distance from the beginning point of a segment.

For basic route control, verbal instructions are recorded on audio tape. Cues for advancing the tape and for activating the vehicle's turn signal lights are added to the route control tape.

To travel over a previously mapped route, the driver simply starts the route at a specified point and follows the system's real-time audio and visual demands.

"For example, when a driver approaches an intersection where a left turn should be made, the left turn signal goes on and a voice message gives the command: 'turn left', and names the street," Rapp explained. "The driver needs to make no reference to maps or subscriber lists."

If a driver departs from his specified route, or misses a command, the system sounds an error signal, then produces a message describing the error and gives instructions for corrective action.

The paper throwers mounted by open windows on either side of the van wear earphones that receive the signals telling them when to hurl their rolled-up papers. Lead times for the throwers are automatically adjusted to the speed of the truck, which may be travelling anywhere from 15 to 30 miles an hour along its routes.

The system is accurate down to the last front porch, whether the route is one mile or 100 miles long, according to Rapp.

"On one six mile test run, we compared the location indicated by the system with the true location at 40 random points," Rapp said. "The average difference was 3.76 feet, and the maximum disparity was eight feet."

The system has a few other benefits for its users, in addition to improving subscriber service and lowering distribution costs, which can be reduced by one-half, Rapp claimed.

For example, when the route is mapped, non-subscriber addresses can be listed to pinpoint new targets for sales activities. And the need for post delivery report writing is eliminated because data can be entered into a main office computer system by the driver, including such transactions as collections for subscriptions, the number of items delivered, and the like. Such information and other relevant data is fed into a central subscriber data system located at the newspaper headquarters, providing updated subscriber information and directional instructions, and centralised and accurate customer billing.

With production of the newspaper delivery system well underway, Avcon is now working on the development of other minicomputer-based systems for similar applications that will have an even broader role for the computer.

In a new system being put together for bread delivery trucks, for example, the computer will not only direct the driver along his route but will also handle his inventory computing problems and his daily accounting for accounts receiving, according to Rapp.

In this respect, the full power of the computer will be put to work in the calculating of invoices and delivery tickets, recording pertinent information for marketing studies (such as potential customers and those serviced by competitors), as well as noting cash received and disbursed and items delivered during the day. The system thus provides a full accounting at the end of the day for all transactions — and telling the driver what to order for delivery tomorrow.

You can cut the risk of electrocution with

Core-Balance Earth-Fault Protectors

by LEO SIMPSON

Ever had a nasty electric shock from an appliance or mains wiring? Even if you have had one, you may not have realised that it could easily have been fatal. In view of the risk of fatal shock, there is a lot to be said for the protection offered by devices known as "core balance relays."

Just about every time a person uses a mains-operated appliance, he or she is exposed to the possibility of electric shock. Fatal electric shock. All it takes is an insulation breakdown to the metal frame of the appliance, together with a broken earth wire in the power cord, and the scene is set for a nasty event.

Maybe the appliance has a frayed power cord with exposed wires, or perhaps it was wired incorrectly. There is always the risk of a power tool or lawnmower cutting its own cord. And people will poke knives into toasters, or even light their cigarettes from electric radiators! When you consider that the average home may contain anywhere between 20 to 40 plus light fittings, power points and so on, the possibilities for electric shock are almost endless.

But the home is just one area where shocks can occur. Other hazardous areas are swimming pools, construction sites and concert halls — even the intensive-care wards of hospitals.

Statistics show that the majority of electrocutions and severe electric shocks occur when the user accidentally becomes the current path betweem mains active and earth. Because of this, a major advance in electrical safety is provided by devices known as "core balance relays" or "earth fault protectors." These can cut off the power automatically when a shock or fault situation occurs, so that instead of being killed the user will at worst get an unpleasant "jolt."

The principle of operation of these devices is as follows: In simple terms, the electricity you use comes via an "active" wire and returns to the substation via a "neutral" wire. Normally the currents in both wires are the same and equal. But when a person receives an electric shock, some current flows from active to earth (in the majority of cases) so that slightly more current flows in the active wire than in the neutral wire.

A "core balance relay" or "earth fault protector" senses the imbalance of current (hence the name) and cuts off the power before the shock becomes severe. Fig 1 illustrates operating principle.

Both active and neutral wires pass through a toroidal magnetic core so that the conductors become the windings of a transformer. These windings are so connected that the magnetic fields generated by the currents in each wire cancel out when the currents are equal. A third winding monitors the residual magnetic flux in the core. If the active and neutral currents become unequal, the flux in the core rises to a point where the third winding generates sufficient voltage for a circuit breaker to be tripped.

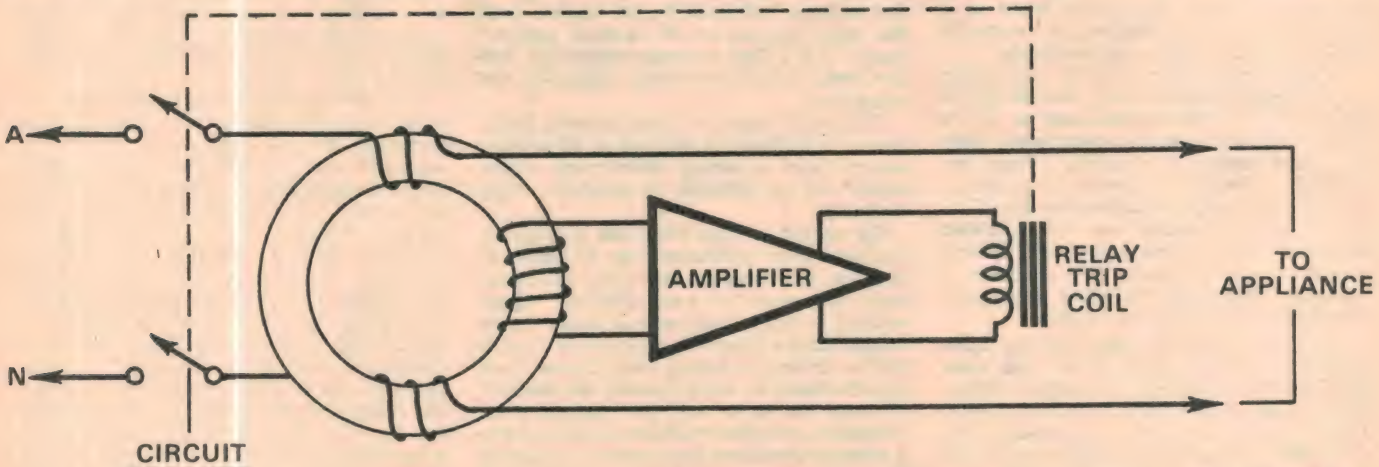
A toroidal core is used for the transformer because this has a very low flux leakage and thus can be used to indicate a very small degree of current imbalance. The same principle of operation is used to protect 3-phase distribution systems.

Typical sensitivity of core balance relays is high — of the order of 20 to 30 milliamps. And the typical response time to kill the power circuit is of the order of 30 milliseconds.

Readers may wonder why the core balance relay needs to have such a high sensitivity and quick release times. Apart from getting you "off the hook" quickly to minimise the pain, there are very vital reasons.

First, let us state that it is not the applied voltage but rather the resulting current which determines the severity of an electric shock. A current of as little as 10 milliamps can provide quite a severe and painful shock. Currents from 10 milliamps to 50 milliamps cause physical shock (in the medical sense), muscular paralysis and upset breathing.

But it is currents of the order of 50 to 200 milliamps which are extremely dangerous, because they can cause ventricular fibrillation of the heart. In this condition, the heart is jolted out of its normal pumping rhythm into a quivering jellylike state — in which it cannot maintain circulation. The only way the victim can be saved in this situation is for external cardiac massage to



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At left is a Core-balance circuit breaker for the home switchboard while at right is a portable unit with two 3-pin sockets in the base.

be applied immediately, along with mouth-to-mouth rescusciation (because breathing generally stops at the same time). Cardiac massage must be maintained until the victim is admitted to a hospital, where electric shocks can be applied to jolt the heart back into its normal rhythm.

So there it is. A moderate shock of the order of 50 to 200 milliamps can cause ventricular fibrillation in the victim's heart, and if he is not lucky enough to have persons standing by to apply instantaneous cardiac massage and arrange for admission to hospital within about half an hour, he is as good as dead.

Even shocks which last only a comparatively short time, less than a second for example, can cause fibrillation if the shock coincides with a critical 0.15 second phase at the end of the normal heart cycle of around 0.75 second. As Dr James Loughman, who is a member of the NSW Hospitals Commission committee on electrical safety, puts it: "It's just so easy to receive a belt — and so easy to die from one that it's not funny."

Clearly, for shocks exceeding 50 milliamps it is vital that the electricity supply be cut off in as short a time as possible; hence the value of a core balance relay. This does not provide protection by limiting the value of the shock current, it merely acts to cut off the power quickly. So the victim still receives a shock, but a very short one, and one that could have been fatal if the core balance relay had not been in operation.

It is interesting to note that the United States' National Electric Code as of January 1st, 1973 requires all 15 and 20-amp outdoor receptacles to be equipped with earth fault protection. Closer to home, the Queensland Department of Labour and Tourism requires power outlets on construction sites and similar situations to have some form of earth-fault protection.

And just recently the Standards Association of Australia has modified the SAA Wiring Rules CC1, part 1 in amendment No 6, with regard to swimming pools. Lighting circuits to underwater lighting of swimming pools must now be provided with core-balance earth fault protection.

We must point out, at this stage, that core-balance relays provide a far greater degree of protection than the commonly known voltage-operated "earth-leakage circuit breaker." These devices are generally regarded as unsuitable these days and most houses do not have them installed.

A core-balance relay is far superior to an earth-leakage circuit-breaker since it does not rely on earth connections to provide protection. And it has the further advantage that it is not subject to "nuisance tripping" because of lightning strikes, electric trains or faults in houses "half-way down the street."

One other term which readers may meet should not be confused with "core-balance relays" is "Earth Fault Detector." This does not provide protection against earth faults but is designed to continuously monitor the insulation resistance between the electrical system and earth and give a warning at an adjustable threshold of failure. It is not used domestically but in factory plants with continuous processes and in hospitals to protect patients in intensive care wards and operating theatres.

Having described the advantages and general operating principle of "core balance earth fault protectors," to give them an all-encompassing title, how do you get this protection? Ideally you have one installed by an electrician on the main switchboard of your house. The Scanelec Safeguard is a typical unit. Price is $42.00 plus installation cost, not much to save a life. It is a 4-pole unit rated at 25 amps per pole at 415VAC for a 3-phase installation. Alternatively, for a single-phase installation (the normal two-wire mains connection) it can be used as a 2 x 2-pole unit for a total rating of 50 amps at 240VAC.

For either 3-phase or single phase systems, this unit will provide complete protection all normal domestic installations, both inside and outside the house. There are some provisos though. For example, hot water heaters, whether instantaneous demand or off-peak types, are not included in the circuit. This is because they always have some current leakage to earth, because of their open-element construction. But in any case such devices are positively earthed by the water pipes to which they are conected, so there is no real problem.

Electric ranges are also generally not included in the earth-fault protection circuit. This is particularly so with earlier models, which tended to have poor sealing of the elements, and consequently some leakage to frame. But electric ranges are usually also very well connected to earth so this is again not a problem. As far as we can determine, there have been no deaths attributed to faulty electric ranges.

While a core-balance earth-fault protector installed at the user's switchboard protects the user while he is at home, he can still be killed using a power tool on a construction site, in a neighbour's backyard or anywhere else. For this reason, Scanelec market a portable core-balance relay. Also called the Scanelec Safeguard, this has two general-purpose 10-amp power outlets with individual switching. Principle of operation is the same as the switchboard model, and the price is $60.00.

Enquiries for Scanelec products should be directed to electrical distributors or to Scanelec Pty Ltd, 248 Coward Street, Mascot, NSW 2020.

Other companies market suitable equivalents to those shown in this article.

In conclusion, we must sound a warning. The earth-fault protector system is only able to protect against electric shock caused by current passing through a person's body to earth. While this is by far the most common cause of fatal electric shock, it is still possible to receive a shock by coming into contact with both the active and neutral conductors. This condition will not trip any core-balance protection device.

The use of these devices cannot replace normal safe practices — including adequate earthing of electrical installations in accordance with the SAA Wiring Rules.

Simple converter for the VHF bands

Here is a third design in our current series of simple receiving converters, this time tuning selected bands in the VHF spectrum. It uses the same printed board as before, and like the earlier designs is easily built up.

by IAN POGSON

This is the third of a series of converters currently being described. The first one was published in April, 1973 and covered the range 6MHz to 19MHz; the second one appeared in June, 1973 and it covered the range 2MHz to 6.5MHz. We are now moving into the VHF spectrum and details are given for tuning a number of selected bands within this range. Readers who wish to tune other bands not specifically provided for may do so within the limits of the circuit, by interpolating from the data given for coils, padders, etc.

The VHF tuning ranges which we consider to be perhaps the most popular, and those for which we give details are: 52-54MHz, 70-85MHz, 118-136MHz and 140-150MHz. The first and last bands are the 6-metre and 2-metre amateur bands; 70-85MHz includes taxis and other commercial services, while 118-136MHz includes aviation channels.

It may well be asked, why cover 140-150MHz when the amateur band only covers from 144 to 148MHz? In a converter of simple design such as this one, it is not easy to cover only a very small percentage at such high frequencies. Certainly it can be done, but it means quite a bit of delicate "fiddling" with the relevant circuit constants, particularly those of the tunable oscillator. Left as it is, the tuning rate is still quite good, while the ability to tune signals on either side of the amateur band may perhaps be seen as a bonus.

Although we give details for four separate tuning ranges, it should be pointed out that the converter can only be set up to tune one band. No provision is made for coil changing as this would complicate the converter to the point where serious difficulties may be encountered by readers. Generally speaking we are of the opinion that most readers will be interested in only one band.

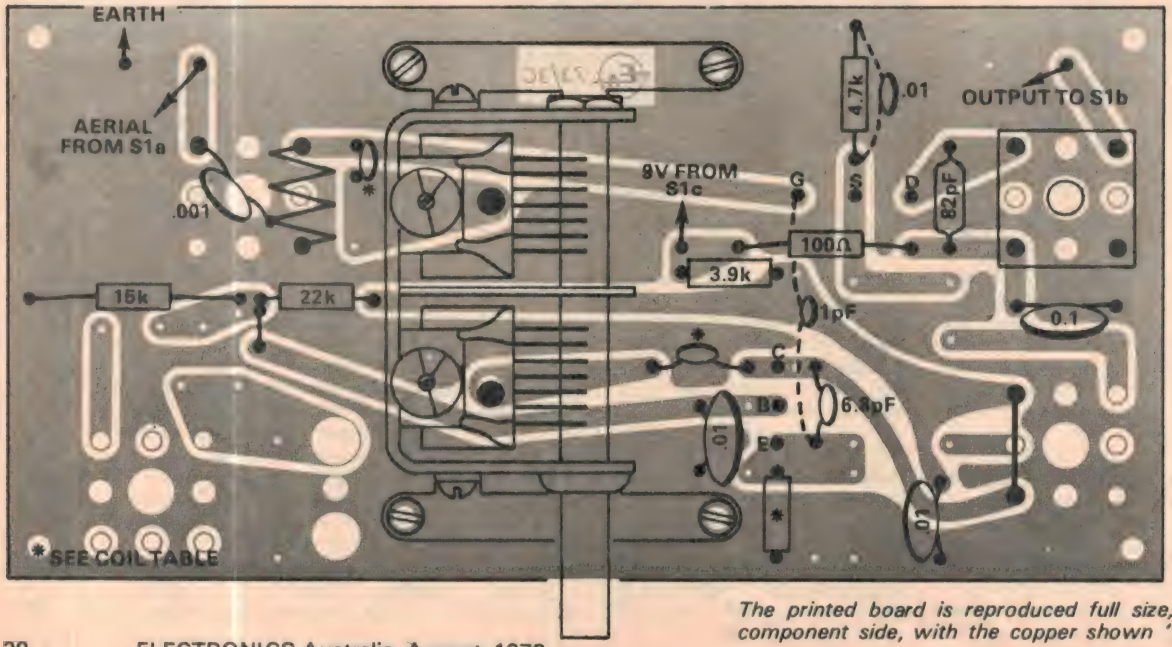
The circuit is similar to the previous ones, but there are certain differences brought about by differing techniques as the frequency is taken higher. The first difference to be noted is that the tuned aerial coil does not have a separate winding for inductively coupling the aerial to the tuned circuit. Instead, the aerial is fed via a .001uF capacitor to a tap on the tuned coil. Instead of a standard 10-415pF 2-gang tuning capacitor, we are now using a more specialised 10-24pF unit, still a 2-gang and fitted into the same "tub" as previously. To govern the range tuned by each circuit for various bands, a series "padder" is introduced.

Injection into the FET mixer is quite different from that used before. Instead of injecting into the source, the gate is used. The capacitance required under these conditions is very small — 1pF. Injection from the oscillator is derived from the emitter of the oscillator, rather than from a coupling winding on the tuned oscillator coil. The output transformer, instead of being a ready made broadcast aerial coil used back-to-front, is now a specially wound transformer.

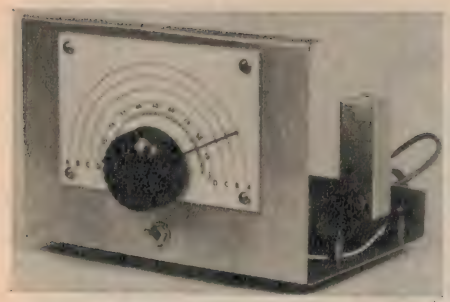
The need for a different output transformer arises from the desirability of using a higher value of first intermediate frequency. At 1.5 or 1.6MHz, image response would be a considerable problem at VHF. We have selected 3.5MHz as one which will give an improved image response, also as one which should be readily available on most receivers for short wave use. Ideally, as we go higher in frequency, so should the first IF be increased. However we have decided on 3.5MHz as a good compromise.

The tuned local oscillator is still basically the same as used on the earlier converters but there are differences brought about by the use at the very high frequencies. The oscillator was a Hartley but it has reverted to a Colpitts, simply by omitting the capacitor from the oscillator coil centre tap to the emitter. The 6.8pF capacitor was previously 12pF. For frequencies in the lower VHF ranges, the emitter resistor is still 3.3k. However, as we go higher in frequency, it is necessary to reduce the emitter resistor in order to maintain oscillation. A value of 470 ohms is satisfactory under these conditions.

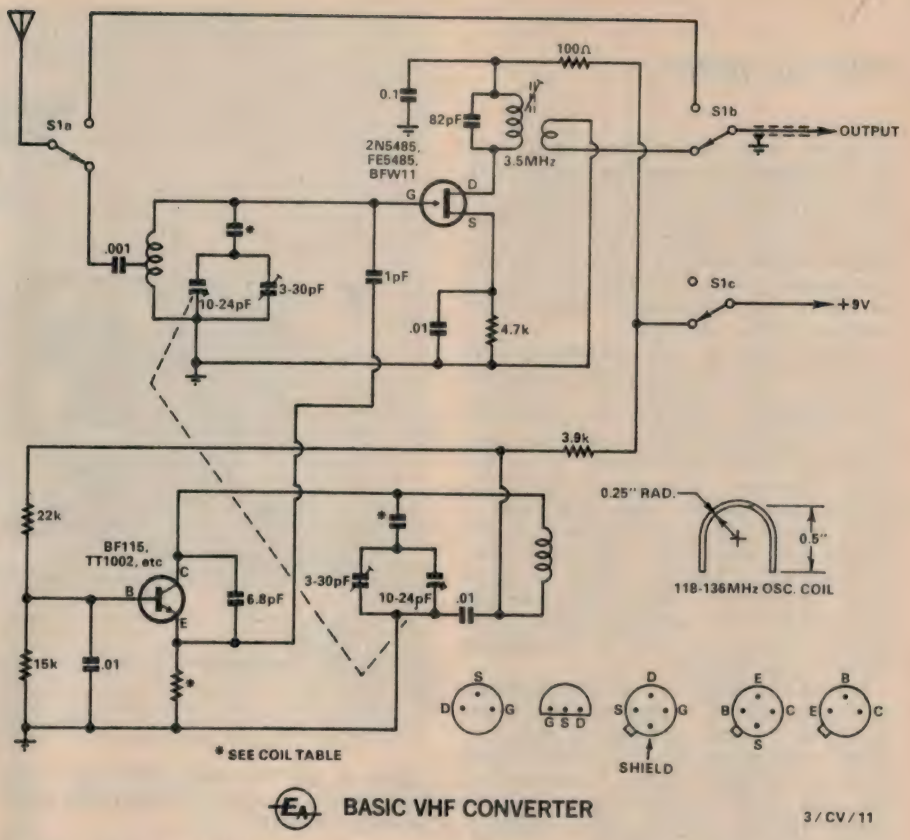
As we mentioned in earlier articles, the printed board has been designed to accommodate these changes. In fact it is able to accommodate quite a few more changes, leading to other converters which we hope to describe in the near future.



The printed board is reproduced full size, is viewed from the component side, with the copper shown "ghosted".



Above is a front view of the converter with the old dial and at right is the circuit diagram, which should be studied with the text.



BASIC VHF CONVERTER 3/CV/11

LIST OF PARTS

1 Chassis-panel, 165m long x 127mm high x 127mm deep.
1 Cabinet to suit
1 Dial assembly, Jabel 6 / 36N
1 Flexible coupling, ¼in x ¼in, Jabel
1 Miniature toggle switch, 3-pole, 2-position
2 Terminals, 1-red, 1-black
4 Rubber feet
1 Grommet for coax cable
6 Spacers, ½in long x ¼in diameter, tapped ⅛in Whitworth
1 Printed board, 6in x 3in, 73 / 3C
1 Neosid coil former, 7.6mm x 60mm, with can and 2 grade 900 slugs
1 Transistor, 2N5485, FE5485, MPF106
1 Transistor, BF115, TT1002, or similar

RESISTORS (½W)

1 100 ohms
1 470 ohms (see coil table)
1 3.3k (see coil table)
1 3.9k 1 4.7k 1 15k 1 22k

CAPACITORS

1 1pF NPO ceramic
1 6.8pF NPO ceramic
2 10pF NPO ceramic (see coil table)
2 15pF NPO ceramic (see coil table)
1 10-24pF Roblan 2-gang variable
2 27pF NPO ceramic (see coil table)
2 30pF Philips trimmers
2 56pF NPO ceramic (see coil table)
1 82pF NPO ceramic
1 .001uF 400V ceramic
3 .01uF 400V ceramic
1 0.1uF 25V ceramic

MISCELLANEOUS

Hookup wire, 2ft coax cable, solder, screws, nuts, piano wire.

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

Apart from the circuit changes just outlined, this converter takes on the same format as before. The metalwork is the same and apart from the dial scale, the external appearance is the same. We are still using one of the older Jabel dial assemblies and it should be pointed out again that these are no longer made in this precise form. The mounting holes are the same but the dial scale is now covered with a perspex moulding. This makes the assembly bigger but we have already allowed for this in our metalwork drawings.

While we are on the subject of dials, we should mention that we have not attempted to give any dial calibrations. The difficulty of aligning to a pre-calibrated dial is so great at VHF that we decided to leave it up to the individual to calibrate according to his own requirements. More will be said about this when we deal with adjustments later on.

Perhaps it is an obvious statement but before construction can start, you must decide which band is to be covered. Information for winding all coils is given in the table. Included with this are also the values of padder capacitors and emitter resistor required. If you wish to cover some other range not given in the coil table, then you will have to interpolate to arrive at a starting point for coils for the frequency of your choice. We must point out that we are unable to enter into any discussions relating to this, however, as there are many potential problems.

No trouble should be experienced in winding or otherwise making the tuning coils. No formers are required, as they are made with a heavy gauge of wire and are physically self-supporting. Where an inside diameter is given, the coil may be wound on a drill or piece of rod of the required diameter. This done, the winding is spaced evenly to occupy the length and the ends are then neatly bent so that they will fit the appropriate holes in the printed board. The oscillator coil for the 118-136MHz band is a hairpin shape and details are shown on the circuit diagram. The oscillator "coil" for the 140-150MHz range is simply a link of 16B&S wire, hard against the surface of the board.

The tap on each of the aerial coils is easy to make. At the appropriate point, a little of the enamel is scraped off, the part tinned, and the capacitor is then soldered to it. Only enough lead should be left on the capacitor so that it just reaches comfortably between the tap and the point on the printed board.

Regardless of the selected tuning range, you will need an output transformer. This is wound on a Neosid 7.6mm diameter former and consists of a primary and secondary winding. The primary is wound first and it consists of 120 turns of 28B&S enamel wire, close wound. The start and finish of this winding may be anchored with a small piece of adhesive tape, slipped under a few turns at each end during winding. The end protruding is then folded over the top of the winding when completed. The secondary winding is 12 turns of 28B&S enamel, over the bottom end of the primary, after having placed a piece of tape over that part of the primary. Again, tape is used to anchor the winding in place.

To ensure that the windings stay firmly intact, they should now be given a coat of cellulose lacquer or other suitable material. When dry, the leads should be terminated such that when the coil is fitted to the board, the pins correspond with the relevant parts of the circuit, as shown in the diagram. Note that two slugs are needed to make the coil tune to 3.5MHz with 82pF.

Before leaving the output transformer, it may be noted that the screws used for holding the can to the former and for chassis mounting as well, are 6BA. If you have 6BA screws, all is well. However, they are not always easy to get and an alternative is to retap the threads in the former to ⅛in Whitworth.

We have already mentioned that we are using a gang made specially for tuning at VHF. However, we found a problem related to the gang as we went above 100MHz or so.

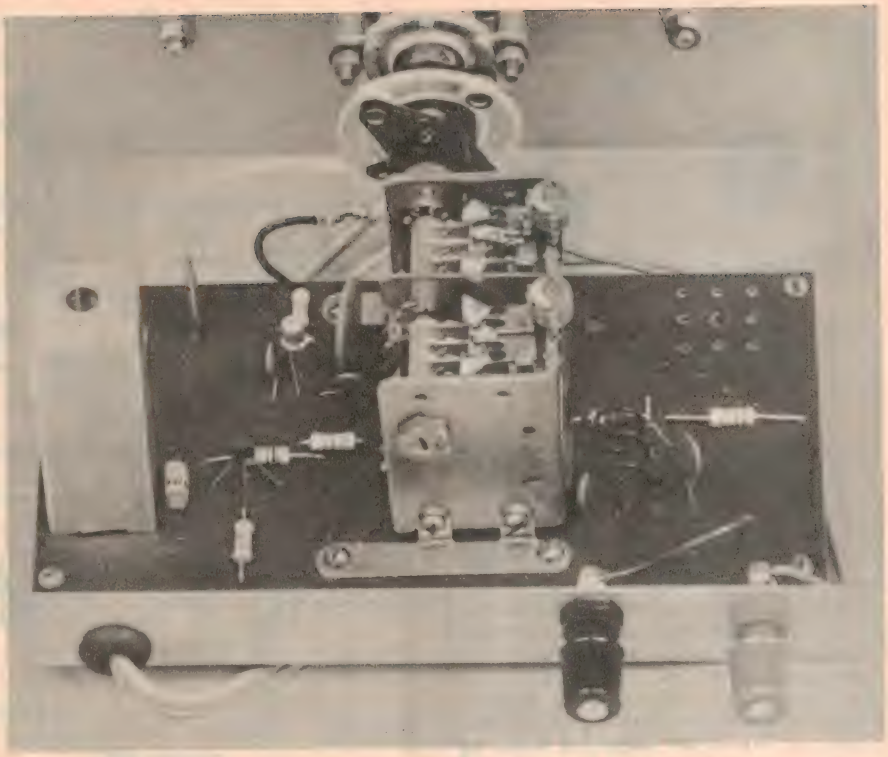
Oscillator tuning became quite erratic and this was traced to irregularities in the earth return of the rotor section of the gang. The manufacturers of the gang took the usual precaution in providing a wiper between the frame and the centre of the rotor, but this was apparently not sufficient. We found it necessary to provide another wiper, at the oscillator end of the gang.

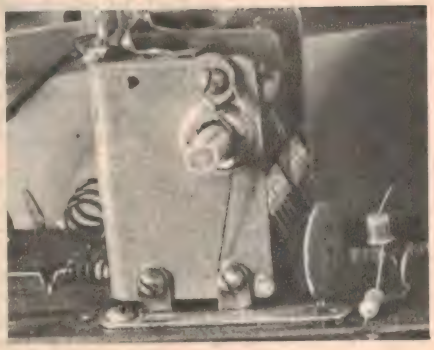
Readers may be able to come up with other methods of doing the same thing, but we used a piece of 28SWG piano wire, about 8cm long, fitted as shown in the picture. One end is looped and fixed under the foot mounting screw immediately below the shaft. The wire is drawn as tightly as possible and another loop terminates it under another screw and two washers, in a tapped hole above the shaft. The two washers are used as convenient spacers to make termination easier. This arrangement results in the wire wiping the rotor spindle, which we found to completely eliminate the trouble.

We are now ready to wire and assemble the components. It is generally convenient to put the resistors, capacitors and other small components on the printed board first. Care should be taken to make a neat job, with resistor and capacitor pigtails kept as short as possible. When soldering, avoid overheating components.

Apart from the output transformer, it may be noted that the coils are fitted through holes in the board normally provided for the pins of coil formers. Unused holes are left vacant. We found it convenient to place the 1pF capacitor and the .01uF capacitor shunting the 4.7k resistor underneath the board. These components should not be forgotten, as their omission will seriously upset the performance of the finished unit.

Before the 2-gang variable capacitor is fitted to the board, leads must be soldered to the bottom lugs of the fixed plates. Use about 8cm of 20 gauge tinned copper wire, wound firmly around each lug before soldering. This will stop the soldered joint from coming adrift when the other end of the lead is soldered to the board. A trimmer must also be soldered to each section of the gang and as may be seen from the picture, we used the new solid dielectric type. If you have the old "beehive" trimmers, then use them by all means. Care should be taken when soldering the former trimmers in place to make sure that a good soldered joint is made in each case, without damaging the trimmer by burning or overheating.





Above is the rear view, showing major components. At right: the front of the gang, showing the wiper wire.

Having completed the board, leads must be added to go to external points. Leads of sufficient length are soldered to the earth point near the earth terminal on the back skirt of the chassis, the aerial of the coil to the switch, the +9V point to the switch, the IF output to the switch and from an earth point near the 3.3k or 470 ohm resistor, to earth the IF output braid on the coax.

The two terminals, rubber grommet, switch and dial assembly may now be fixed to the chassis-panel. As mentioned earlier, the dial we used is no longer made but if you have one on hand, then it may be used, as the mounting holes remain the same. As an alternative to the new dial which we have suggested, you may see fit to make other arrangements, possibly still making use of the dual ratio drive by Jackson Bros. This drive is available as a separate unit from Messrs Watkin Wynne, 32 Falcon Street, Crows Nest, NSW 2065.

At this stage, a careful check should be made to ensure that no errors have been made on the board assembly and elsewhere. Satisfied that all is well, the board may now be screwed to the chassis, not forgetting the flexible coupling between the gang and the dial drive. A short spindle is required between the drive and the coupling and this may be obtained from an offcut of a potentiometer spindle.

All interconnecting leads should now be terminated. The switch connections should be carefully studied to ensure correct operation. We used the centre section to switch the +9V supply, with the other two used for the aerial and IF output respectively. We arranged the wiring such that when the switch toggle arm is uppermost, the converter is switched off and the aerial is fed directly into the main receiver. With the switch operated, the converter is switched on, with the aerial fed to it and the output of the converter is then fed to the receiver. The coax cable and a lead for the +9V supply are passed through the rubber grommet. If desired, a separate negative lead for the supply may be provided and connected to the earth copper of the board.

With the mechanical work complete, we are ready to adjust the converter and put it

COIL DETAILS FOR FOUR BANDS

52-54MHz
Aerial: 8 turns, tapped 2 turns from earth end, 18B&S enamel, ½in ID x 14mm long. Padder 10pF.
Oscillator: 8 turns, 18B&S enamel, ½in ID x 21mm long. Padder 10pF. Emitter resistor 3.3k.

70-85MHz
Aerial: 5 turns, tapped 1 turn from earth end, 18B&S enamel, ⅜in ID x 11mm long. Padder 56pF.
Oscillator: 4 turns, 18B&S enamel, ⅜in ID x 10mm long. Padder 56pF. Emitter resistor 3.3k.

118-136MHz
Aerial: 3 turns, tapped ¾ turn from earth end, 18B&S enamel, 5 / 16in ID x 8mm long. Padder 27pF.
Oscillator: Hairpin, ¼in rad, 18B&S TC, ½in above board. Padder 27pF. Emitter resistor 470 ohms.

140-150MHz
Aerial: 3 turns, tapped ¾ turn from earth end, 18B & S enamel, 5 / 16in ID x 19mm long. Padder 15pF.
Oscillator: 16B&S TC link across appropriate holes on board. Padder 15pF. Emitter resisto 470 ohms.

3.5MHz Output Transformer
Primary, 120 turns, 28B&S enamel, on Neosid former, 7.6mm x 60mm, 2 grade 900 slugs. Secondary, 12 turns, 28B&S enamel, over earthy end of primary.

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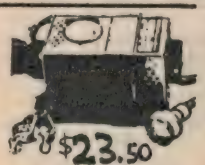

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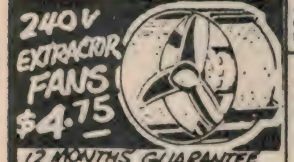

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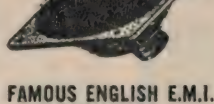

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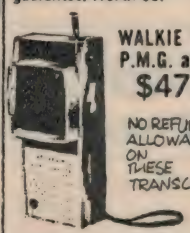

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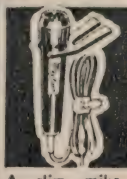

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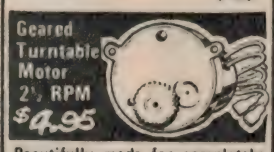

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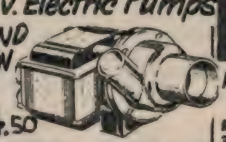

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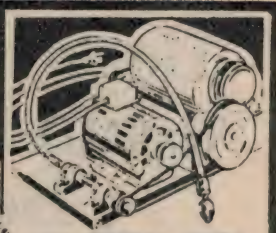

GEM TUMBLER OUTFIT $32.50

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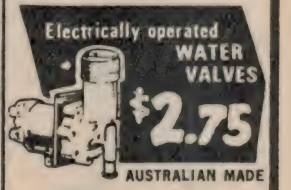

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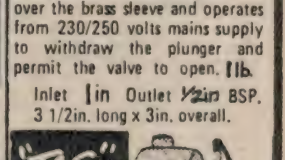

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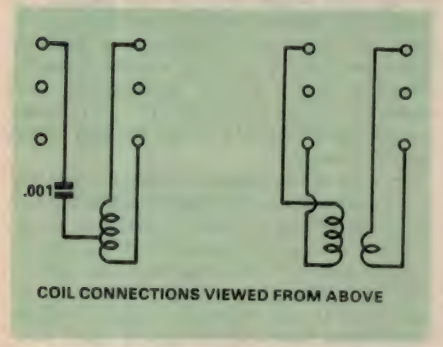
into operation. We will assume that you have a suitable receiver — one which will tune 3.5MHz. If the receiver has a suitable supply, then the converter may share it. On the other hand, a separate 9V battery will do just as well. We will also assume at this stage that there is a suitable aerial.

Connect the converter to the receiver and its power supply. If you have a signal generator or have access to one which covers the frequencies of interest, then alignment will be that much easier to do. With an accurately calibrated signal generator, you may also calibrate your own dial scale.

Regardless of the frequency band which you have chosen, the method of alignment will be the same. During the process of alignment, the output level of the generator should be adjusted to avoid overloading the converter and receiver. Set the receiver to 3.5MHz and feed a signal from the generator set to 3.5MHz, into the aerial terminal of the converter. Adjust the slug in the output transformer for maximum response.

With the gang fully closed and the dial pointer set to 100 or other full scale reference point, tighten all dial drive grub screws. Set the trimmers on the gang so that they are about one quarter in mesh.



COIL CONNECTIONS VIEWED FROM ABOVE

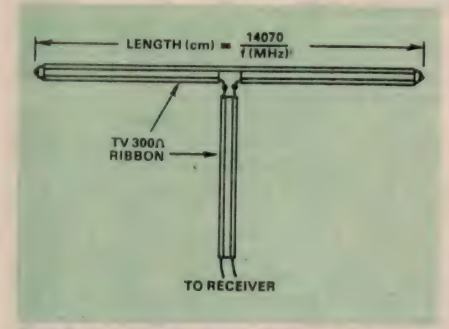
Now search with the signal generator at around the wanted low frequency of the converter, until a signal is heard. Tune up 7MHz higher in frequency with the generator and the image should be heard. If no signal is found, then you were already tuned 7MHz too high. Having established the lower frequency, if it is too high, then the oscillator coil must be squeezed up until the right frequency is reached. If the frequency is too low, then the coil should be lengthened until the correct frequency is reached.

With the oscillator coil tentatively adjusted, the aerial coil must be brought into line with it. This can best be done by first testing to determine whether the coil is tuned either too high or too low in frequency. Take an ordinary iron dust or ferrite slug, 7-8mm diameter and approach the coil with it. If the signal strength drops, then the coil should be lengthened, to the point where maximum signal response is achieved. Should the slug result in an increase in signal strength, then the coil must be squeezed up until maximum signal response is reached.

Now tune the converter to the high frequency end of the dial but instead of setting the pointer to the extremity of the scale, it should be brought back by about 5pc. This will be the highest frequency point of the scale. Again search with the generator around the wanted high frequency point of the converter and establish the actual frequency to which the converter is tuned. Also, check that there is an image response when the generator is tuned 7MHz higher in frequency. Having established the actual frequency, set the generator to the wanted frequency and adjust the trimmer on the oscillator section of the gang until the signal is heard again. Now adjust the trimmer on the aerial section of the gang for maximum response.

In common with all superheterodyne receiving systems, the alignment procedure must be repeated at each end of the scale, until correct adjustment of oscillator and aerial tuning systems is achieved.

Readers may be wondering just how a "hairpin" coil, or a simple wire link can be adjusted to satisfy the foregoing alignment procedure. Well, the hairpin can be adjusted by unsoldering and slightly lengthening or shortening the arms as required. The parallel arms of the hairpin may also be brought closer or taken further apart, as an alternative means of adjustment. * With regard to the link, we agree that there is little that can be done to alter its inductance. Either you must settle for what it provides or you may change the value



At left, the coil connections are shown as viewed from above. Details of a folded dipole aerial are shown above.

slightly of the paddor capacitor in series with it.

If you do not have access to a signal generator, then the task of alignment is not so easy. The output transformer may be adjusted on a subsequent signal, or even noise, with the receiver set to 3.5MHz. Alignment on the VHF range of your choice will depend upon the reception of signals of known frequencies and with calibration points set on the dial accordingly. Perhaps one of the best aids to alignment would be the sound channels of the various TV transmissions. The following is a list of the sound frequency for each of the channels.

0 — 51.75MHz; 1 — 62.75MHz; 2 — 69.75MHz; 3 — 91.75MHz; 4 — 100.75MHz; 5 — 107.75MHz; 5A — 143.75MHz; 6 — 180.75MHz; 7 — 187.75MHz; 8 — 194.75MHz; 9 — 201.75MHz; 10 — 214.75MHz; 11 — 221.75MHz.

An efficient aerial system is most desirable for use with this converter. A multi-element Yagi or other VHF aerial system would be ideal. If the wanted signals all come from one direction, then the aerial may be orientated to suit. On the other hand, if the signals come from different directions, it is desirable to make provision for rotating the aerial.

(Continued on page 125)

New, Universal Headphone Unit

Does your amplifier have facilities for headphone listening? For two people? With main speakers on or off? If your answer is no to any of these questions then our new headphone adaptor may be just the device you're looking for.

by N. J. MARKS & W. N. WILLIAMS

As will be apparent from the accompanying photograph, the new headphone adaptor is compact, with a pleasing appearance, and can be placed if necessary on an open shelf alongside other items of hi-fi equipment. It does not need to be tucked out of sight.

It is "universal" in the sense that it can be used with virtually any amplifier and it will accommodate two pairs of headphones, which can be of dissimilar type and appearance.

The internal circuitry is so arranged that the level of one pair can be preset, relative to the loudspeaker volume. This semi-fixed channel could also be used with phones having their own in-built level controls.

Volume from the other outlet can be controlled conveniently by front panel knobs to meet varying needs. It can be adjusted, if necessary, to cope with the needs of a listener who is hard of hearing and or afflicted with an imbalance of hearing acuity.

Because of these special facilities, the adaptor may, in fact, find a use with many amplifiers having an in-built but more limited headphone facility.

When considering headphones, it is appropriate to stress that modern, high fidelity headphones exhibit lower distortion and a response that is much wider and smoother than any of the older, general purpose types. Reproduction, overall, compares very favourably with that from high fidelity loudspeakers, with the best headphones comparing favourably with the best loudspeakers. This, in terms of available listening level, clarity of reproduction, frequency response, etc. Subjectively, however, there is a difference in the apparent distribution of the sound, when using headphones.

On fully dispersed stereo program material, the listener has the sensation of sitting within the orchestra, with most of the instruments dispersed on either side.

With the more gimmicky "two-channel" type of stereo recording, the listener has the impression of sitting between two distinct groups of musicians. With a "three-channel" type of recording, there is an additional group inside his head!

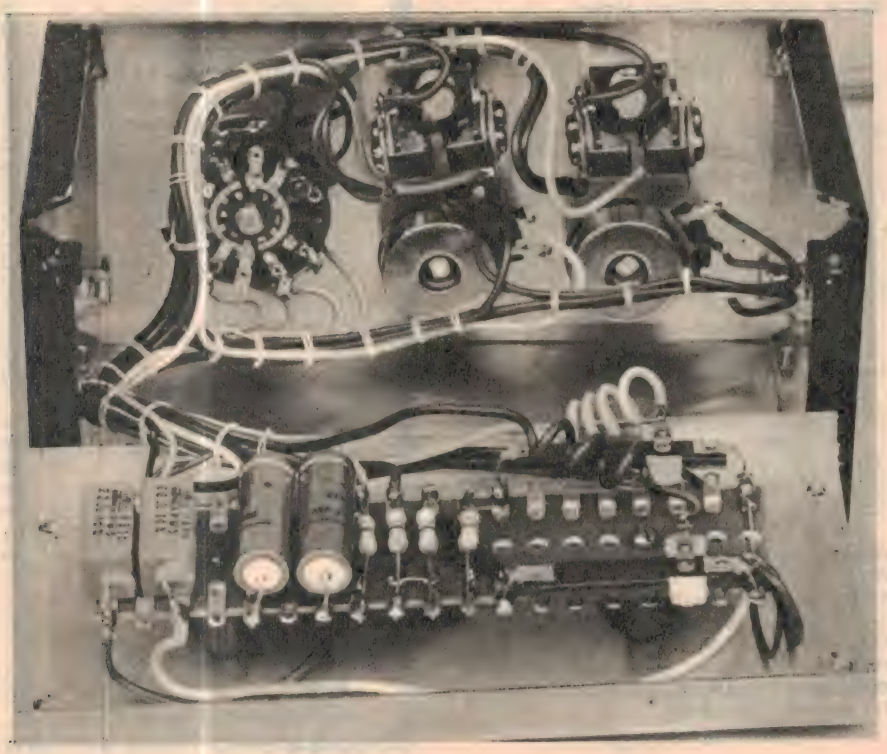
These impressions are not present when listening to a normal stereo loudspeaker set-up. The sound sources are usually in front of the listener, not adjacent to his ears. Each ear hears each sound source, both by direct and reflection paths, and the listening situation more closely approaches that which it would obtain if the performers were actually located at the far end of the listening room.

Because of the different illusions created, it is possible to argue that headphones are not a legitimate method of listening to ordinary stereo program material. Be that as it may, however, the reproduction can be very satisfying and an alternative far to be preferred to no listening at all! In fact, headphones have advantages of their own.

They do not suffer from apparent attenuation of the high frequencies due to "beaming" effects as do loudspeakers, since the headphone aims right into the ear, as it were. At low frequencies, provided the phones are adequately sealed to the head by flexible surrounds, headphones can produce plenty of undistorted bass; they do not have to set up a large wavefront in a room and cannot excite boomy room resonances. Finally, because the diaphragms need to make only small excursions to move a limited amount of air, they may well contribute less distortion than would many loudspeakers.

These arguments aside, the real reason for the increasing popularity of headphones is that they enable one to listen to music at any time of the day or night, without restriction to the listening level, and without disturbing neighbours, babies or parents.

In designing a universal headphone adaptor, a number of matters have to be considered relating to the drive require-



As will be apparent from the picture at the top of the page, our new universal headphone adaptor can be used as a free-standing unit, alongside other equipment. Internally, the use of a tagboard and laced wiring can give it a professional appearance.

ments of headphones and the load conditions presented to the amplifier.

Depending on impedance relationships, headphones clamped to the ears are effectively much more sensitive than any kind of loudspeaker system standing several feet away. This leads to complications which are likely to inhibit the connection of headphones directly to the output stage in lieu of loudspeakers.

The first arises from the fact that practical amplifiers have some inherent noise and hum output, even with the volume control turned right down. Through a loudspeaker system this is normally not troublesome but, heard through earphones, it is often quite objectionable and sufficient to compromise enjoyment of the program.

Another aspect is that since so little audio power is necessary to produce adequate output from the headphones, the volume control may have to be set at a critical position, not far advanced from fully off. If, by chance, it happens to be turned up too far, the headphones could easily be damaged.

A possible secondary effect is that, at such low volume control settings, the balance between the respective sections of the volume control may be anything but good, requiring manipulation of the balance control to equalise matters.

The answer to these problems is the provision in the adaptor of an attenuation circuit (or "pad") such that only portion of the voltage at the output of the amplifier can reach the headphones. It will reduce the hum and noise fed to the phones and allow the amplifier to be operated with the volume control somewhere near setting normally employed for loud-speaker listening.

Such a pad should be so designed that it will work with any type of headphone, irrespective of the impedance. In practice, impedance ratings may range from a few ohms to a few hundred ohms.

One very suitable arrangement, which we have used on a previous occasion is to connect a 47-ohm fixed resistor and a 100-ohm slider or potentiometer in series across each amplifier output circuit. The phones are connected between one end of the slider (or potentiometer) and the adjustable tapping; this ensures a full range of level control in the phones, relative to the amplifier setting, without danger of adversely loading the amplifier's output circuit.

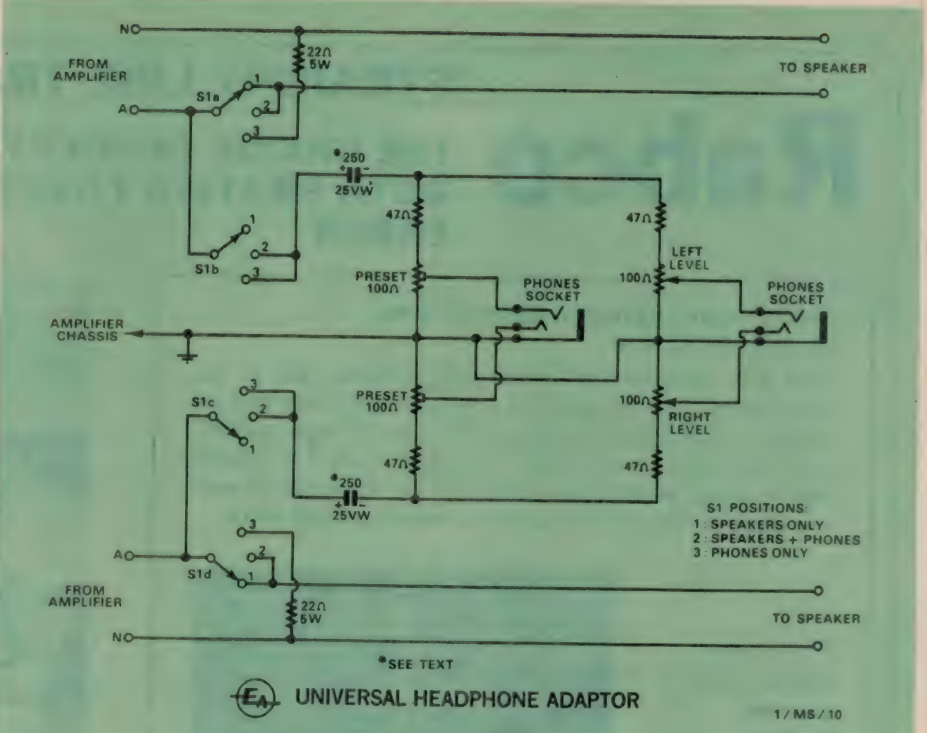
If, as here, it is desired to provide for two pairs of headphones the network in each channel is simply duplicated.

Our adaptor unit provides the appropriate networks, together with switching to connect the headphones to the amplifier, or the loudspeakers, or headphones and loudspeakers simultaneously.

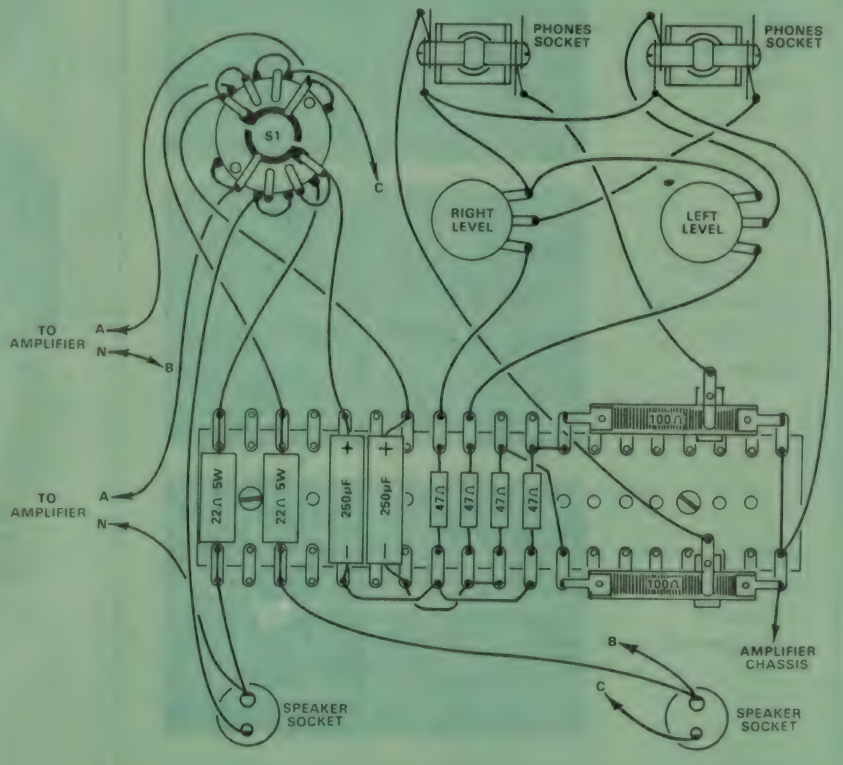
On its own, a headphone network of this type provides only light loading. While most high quality amplifiers are tolerant of this condition, there may be the odd one which will not be so. In any case, complementary symmetry transistor output stages need a suitable DC load circuit, because the load forms part of the bias network.

For the above reasons we have included a 22-ohm, 5-watt resistor as a dummy load for each channel, which is brought into circuit when the adaptor is switched to headphone only. This value is low enough to ensure correct operation of all amplifiers likely to be encountered and is high enough for the 5-watt rating to be adequate for likely levels of operation.

In normal stereo systems, the loud-



Wired as shown in the circuit, the unit retains complete independence of the two loudspeaker output circuits in the straight-through "loudspeaker only" function. By using a blocking capacitor in the headphone feed line and taking the return back to chassis by a fifth lead, a DC path is avoided between the output circuits. In the "Headphones Only" position, a 22-ohm resistor provides loading and a DC path in lieu of the loudspeaker voice coil.



For those who want to make a close copy of the prototype adaptor, this wiring diagram should provide all the necessary information. In fact, the layout is not critical and the unit could be constructed inside any convenient housing, metal or non-metal, more fancy or less fancy than our original. See text regarding the coupling capacitors.

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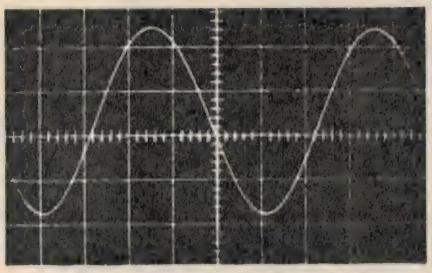
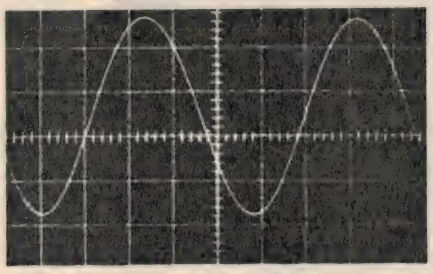
Comparison between pivoted arm and RABCO arm

The four unretouched photographs below are of an oscilloscope presentation of a 400Hz tone recorded on a disc at 25 cm/sec. groove velocity. A high quality, high compliance cartridge was used with 1½ grams stylus force. Anti-skating required by the pivoted arm was set at the manufacturer's recommended force.

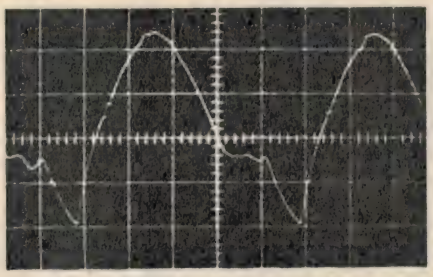
Pivoted arm 400Hz tracing on outer groove.



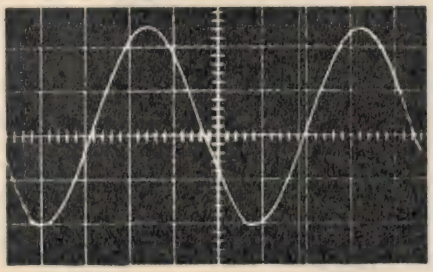
RABCO tone arm 400Hz tracing on outer groove.



Pivoted arm 400Hz tracing on inner groove.



RABCO tone arm 400Hz tracing on inner groove.



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speakers are independent units, each fed by a separate twin lead. Internally, the output circuits of the two amplifiers may be independent of each other in respect to both the active and neutral wiring. It is wise to preserve this isolation, at least in respect to the loudspeakers, to minimise the risk of introducing unforeseen complications.

The need to preserve isolation can be a problem with many types of headphones because they use a common return (or neutral) lead. For this reason we have suggested a 5-wire circuit between the amplifier and headphone adaptor. Four wires maintain the separate active and neutral leads for loudspeaker operation; the fifth wire allows the headphones to derive their drive from between the respective actives and chassis.

One further complication which needs to be provided for has to do with amplifiers which operate with the loudspeaker circuitry above chassis potential: ie neither side of the loudspeaker is returned to chassis earth.

While it may be possible to check on each amplifier with a voltmeter, or by inspecting the circuit, we have provided for the eventuality by including 250uF / 25VW electrolytic capacitors in series with each active headphone feed line. This will prevent the headphones and their related volume controls from providing a DC path between the amplifier active outputs and chassis.

Note that if the DC potential of the voice coil proves to be negative with respect to the chassis, as was the case with one or two circuits we have seen in overseas magazines, the polarity of the electrolytic capacitors in the adaptor unit would have to be the reverse of that shown in the circuit and wiring diagrams.

To make the adaptor truly universal, the isolating capacitors could be replaced by a bipolar configuration derived by connecting two 500 ufd 25VW electrolytics in series opposition ie with the positive leads connected together and the negative leads taken to the rest of the circuit. On the other hand, if you are absolutely sure that the capacitors are not needed with your amplifier, they can be omitted.

In our previous design for a headphone adaptor, we used a diecast metal box to house the components. For this later version we have adopted a more stylish approach by using a small instrument case, comprising mainly aluminium extrusions and pressings.

The case we used is a "Horwood" H43 / 6, approximately 100mm deep, 75mm high and 150mm wide. This case has the advantage of being composed of separate panels, screwed together, which makes for easier work on drilling holes, painting and final assembly. Other styles of case could well suggest themselves to the home constructor. The circuitry could even be built into an existing amplifier, providing panel space is available for the knobs and headphone jacks.

Smaller components were mounted on a 19-lug segment of tag-strip which was spaced off the rear panel by two brass spacers approximately 2cm long, tapped 1/8 Whitworth. Two of the screws holding the loudspeaker sockets are used to mount the spacers which were covered with a length of insulating sleeving to prevent any accidental shorting to the speaker socket connections.

We used McMurdo 2-pin plugs and sockets on the prototype but if your amplifier uses a different type of plug or means of connection, it might be logical to duplicate them on the adaptor.

The two preset sliders are mounted at one end of the tagstrip followed by the 47-ohm dropping resistors, the 250uF isolating capacitors and the 22-ohm dummy load resistors.

The cable used to connect the adaptor to the amplifier should most obviously be a five-core type. Alternately various types of four-core cables with some cores shielded might be more readily available; the braids could be used as the common return to chassis for the headphones.

Terminations are protected by clamping the cable where it enters the case through a grommetted hole. The two neutral leads for the speakers are taken direct to the sockets on the back of the case; the active leads go to the switch.

Once you have completed the adaptor, you can connect it to your amplifier and check for correct polarity of the active and neutral leads.

On those amplifiers with screw terminals for the loudspeaker connections, the active side may be coloured red or coded with a "plus" sign. If this is not the case, the active side of the speaker output may be determined by trial and error when the adaptor is completed; if the headphones are effectively connected between neutral side of the amplifier output and the amplifier chassis, no sound will be heard.

When everything is properly connected, turn the front panel potentiometers and the sliders to their minimum position.

Put a record on the player and with the switch in the "speakers only" position, adjust the volume to the average listening level.

Switch to the phones only position and adjust the sliders to give you a satisfactory level with the phones in the appropriate socket and repeat this performance with the front panel controls and their socket. In this way you won't need to leap for the volume control when you plug in the 'phones for some personal listening.

You won't hear any noticeable difference in speaker output when the selector switch is in the "Speakers plus phones" position, due to the minimal loading of the attenuator network.

Incidentally, if you make up an extension cord using a stereo phone plug and socket, and a length of three-core cable, sound can be conveyed to somebody confined to bed, so that they can enjoy the music along with other members of the family, or alone.

PARTS LIST FOR THE HEADPHONE ADAPTOR

1 Horwood H / 43 / 6 case
1 4-pole 3-position switch. Oak 52259 or similar
2 Stereo jack sockets
1 19-lug piece of component strip
2 Speaker plugs and sockets
2 250uF / 25VW Electrolytic capacitors (see text)
4 47-ohm ½-watt resistors
2 22-ohm 5-watt resistors
2 100-ohm slider resistors
2 100-ohm wire-wound potentiometers
3 knobs, 5-conductor cable or 4-conductor with shield, cord clamp, hook-up wire
2 brass spacers tapped ⅛ Whit 2cms long screws, nuts etc.

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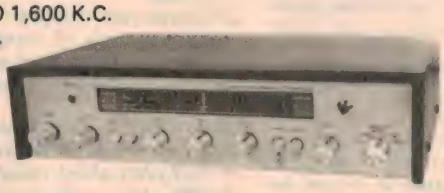

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Mains Monitor

Measure the Mains without getting "zapped"

Ever wanted to check the AC mains voltage while working on a new project, or look at the power consumption of an appliance while trouble-shooting? Here is a simple little unit, using only a handful of low-costs parts, which allows you to measure both mains voltage and current — and without the risk of shock.

LEO SIMPSON

There are often occasions when it is necessary to monitor the AC mains voltage. For example, when checking the line regulation of power supply it is necessary to vary and monitor the mains input voltage. Another case is the power output test of an audio amplifier, where the test may not be valid if the mains input voltage is not correct. Many other situations can arise in the design and testing of circuits and appliances where it is necessary to know the value of the mains voltage.

Measuring the mains voltage with a multimeter is not very convenient and it can be unsafe. For the person inexperienced in such situations it can be a nerve-wracking experience. One must generally push the meter prods into a power point, or measure across the active and neutral pins of a 3-pin plug pushed part way into a power point. Or maybe you can measure the voltage at some accessible point in the circuit or appliance, which is slightly better.

The possibility of a shock arises if the user's hands are perspiring and sweat has accumulated on the meter prods. The electrical leakage path so formed to the user's hands can be sufficient to deliver quite a nasty "bite." Worse, if your hands slip down the prods, you are in direct contact with the mains supply — in the worst possible condition for a fatal shock.

Often it is desirable to monitor the mains voltage continuously and this means that meter has to be disconnected each time some other measurement is required.

Clearly what is needed is a unit which plugs into a standard power point to measure the voltage — so that the user is in no danger of coming into contact with lethal mains voltage.

If voltage measurement poses a problem, that of current measurement is even greater. For a start, most multimeters lack facilities for measuring AC current. If they do have AC current ranges, one of the AC leads to the appliance or circuit must be "broken" so that the meter can be connected in series for current measurement. Sometimes this is easily accomplished by removing the appliance fuse and clipping the meter prods to the fuseholder terminals. Mostly, it is not a simple procedure — especially when the device has a hard-to-disassemble case and a moulded cord plug.

A novel use for an economy transformer.

One ought to be able to plug the appliance into a unit and read the current directly from a meter without fiddling with any connections. The less chance the user has of being exposed to mains voltages, the longer he is likely to remain a reader of "Electronics Australia" and able to pursue all his other activities!

With these thoughts in mind, we developed our AC "Mains Monitor." One can plug an appliance into it and at the flip of a switch, read the AC mains voltage applied to it or its current consumption up to a maximum of 5 amps. Multiplying the two readings together will give the volt-amps consumption of the device, or if the device is a resistive load such as a radiator or incandescent lamp, the power consumption in watts.

With the maximum current rating of 5 amps, our Mains Monitor is limited to measuring the current consumption of appliances with nominal ratings of less than 1200 volt-amps (VA) or 1200 watts. For most appliances this will not be a problem.

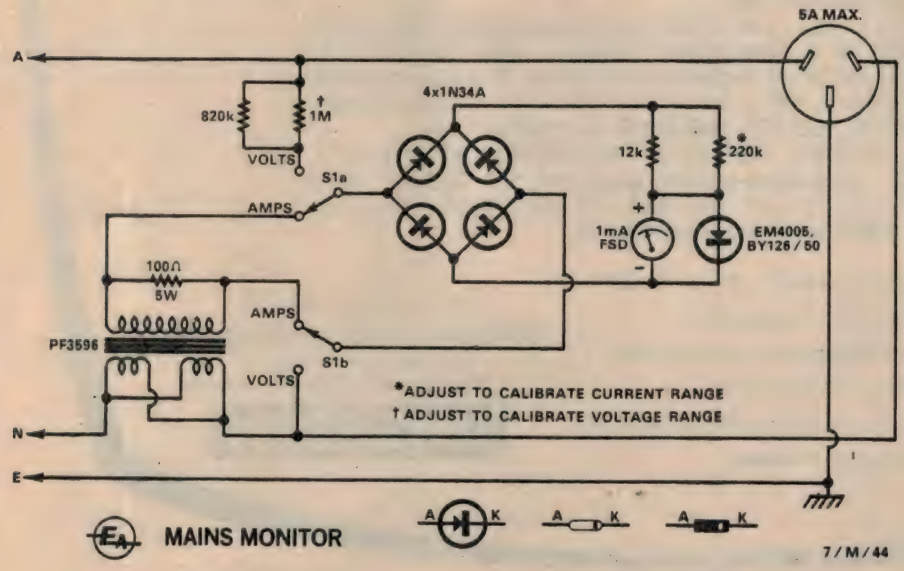
Heart of the Monitor is the Ferguson PF 3596, a low voltage transformer meeting the Australian Standard C126, where applicable with respect to insulation and winding construction. It is used here "backwards," as a current transformer. It has two low voltage windings, each with a nominal rating of 6V at 10VA; these are connected in parallel and the current to be monitored is passed through the composite winding. The 240V "primary" winding is used to develop a voltage proportional to the current in the low voltage windings, across a 100 ohm 5 watt resistor.

A maximum rating of 5A has been decided upon as it results in a power dissipation inside the transformer of a similar order to that in its normal mode of operation when it delivers 20VA to a full wave rectifier with capacitor filter. We strongly advise against modifying the circuit in any way to measure current in excess of 5A. In addition, if the unit is intended to be used measure current near the maximum rating for extended periods, adequate case ventilation must be provided. The transformer will be hot.

In this circuit it is possible that 240 volts AC will be applied between the low voltage windings of the transformer and its core, even though the transformer is shown connected in the Neutral "side" of the circuit. However even if this occurs the transformer is safe since its insulation rating is the same for the low voltage windings as for the 240V winding — we have the assurance of Ferguson Transformers Pty Ltd in this regard. Note that this may not apply to other transformers, so that substitution should only be made after carefully assessing the safety aspects.

The AC voltage developed across the 100 ohm resistor is applied to a bridge rectifier consisting of four germanium small-signal diodes. The rectified AC is then fed to 1mA FSD moving coil meter via a 12k resistor. This results in an FSD sensitivity of 5 amps.

A general-purpose silicon diode shunts the



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INTERDYN

meter movement for applied voltages in excess of 600mV, so that the meter is effectively protected against mechanical damage in the likely event of overload on the current range. Incandescent lamps, motors and transformers all have considerable surge current at switch-on, so this form of protection is very necessary.

Note that the current-monitoring winding of the transformer is in series with the load at all times. The voltage drop across this winding at the maximum current of 5 amps is 2 volts (RMS). This is less than the likely measurement error of the Monitor, so it can be regarded as negligible.

To measure the mains voltage the meter circuitry is switched in series with a multiplier resistor across the active and neutral leads. The multiplier consists of a parallel combination of 820k and 1M resistors.

Switching from the voltage to current ranges is performed by a double-pole, double-throw switch. The switch must be rated for 240VAC operation.

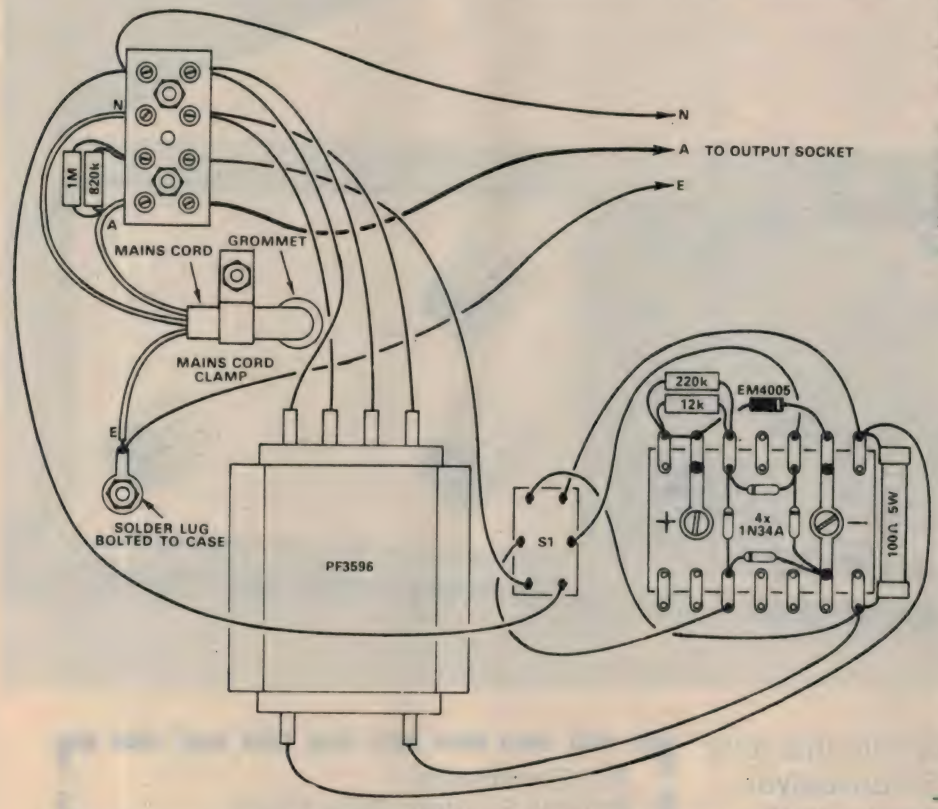
When calibrated, the Mains Monitor will accurately indicate the RMS value of sinusoidal voltage and current waveforms — ie, those most often encountered. It will not give an accurate indication of the value of chopped waveforms from phase-controlled thyristors or Triacs or half-wave rectified AC. To measure these waveforms accurately, an RMS indicating meter is required and a different mode of current sensing.

CONSTRUCTION: Assembly of the Mains Monitor is a straightforward process and apart from satisfying safety requirements, layout is not critical. No doubt many readers will have their own ideas on the format. Our Monitor was assembled in a sloping front panel case, with a three-pin mains socket mounted on one side.

It is important that mains cord termination is done properly. The cord should be passed through a grommeted hole in the rear of the case and securely anchored by a clamp. The earth lead is terminated to a solder lug at the rear of case which also terminates the earth wire from the three-pin socket. The active and neutral wires are terminated on a four-way insulated terminal block, as shown in the wiring diagram.

The transformer is mounted with the normal "240V" winding at the front of the case. The current monitor windings are connected to the four-way terminal block. Also accommodated on the terminal block are the two multiplier resistors for the 240V range.

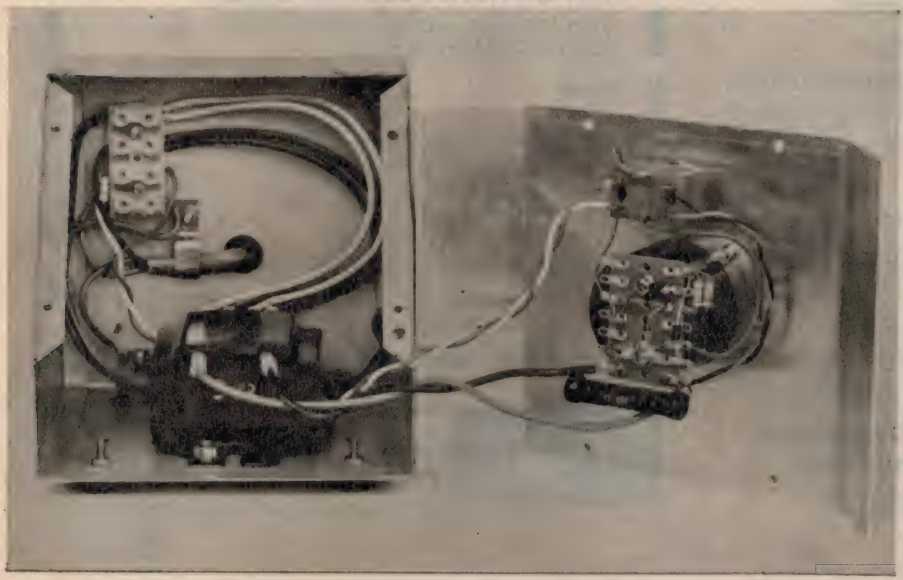
Connection of the two low voltage windings is critical. If it is not done correctly, the magnetic fields from the two windings will not add and the Monitor will not work. See the wiring diagram and inside photograph for the details.



Simple to wire up, the Mains Monitor frees your multimeter for routine measurements.

PARTS LIST

1 sloping front case, 13 x 13 x 13cm.
1 Ferguson PF3596 power transformer.
1 DPDT 240VAC toggle switch.
1 moving coil meter movement, 1mA sensitivity.
1 three-pin mains socket.
4 rubber feet.
1 four-way terminal block.
1 seven-lug length of miniature tagboard.
1 EM4005, BY126 / 50 silicon diode.
4 1N34 germanium diodes.
RESISTORS
(½ watt, 5 pc tolerance unless specified)
1 x 100 ohm 5 watt, 1 x 12k, 1 x 220k, 1 x 820k, 1 x 1M
MISCELLANEOUS
Mains cord and plug, mains cord clamp, solder lug, hookup wire, screws, nuts, lockwashers, solder.



We used a standard 1mA meter movement. The 0 to 1 calibrations were removed with a typing eraser and 0 to 5 substituted with Letraset rub-on lettering. Only one scale is used for both ranges. The reading is multiplied by 100 for voltage so that 250 volts is indicated in the centre of the scale.

Remaining components in the circuit are mounted on a seven-lug length of miniature tagboard mounted on the rear of the meter movement. Do not cut the pigtails of the diodes too short when mounting, otherwise they may be damaged when soldering.

Calibration of the Mains Monitor can only be done by comparison with a meter of known accuracy. Calibrate the current range first, by adjusting the high value resistor in shunt with the 12k resistor. Calibration of the voltage range can now be done by adjusting the 1M resistor shunting the 820k resistor.

If you do not have another meter handy we suggest you install the components we have shown. This will result in an accuracy of about the same as likely component variations, about plus or minus 5 pc.

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Digital Clock - Addendum

Fairly obviously, the Low Cost Digital Clock described in the June issue has been very popular. Already we have received a lot of "positive feedback" regarding the project, including some worthwhile modifications which we are happy to present here. They include three simple schemes to allow conventional readout of the twelfth or twenty-fourth hour.

by LEO SIMPSON

The "Low Cost Digital Clock" published in the June issue of Electronics Australia was attractive in that it was simple to build and contained relatively few parts. However, it did have one major drawback: For 12-hour operation, it counted to 11.59 and then reset to 00.00 and so on. Similarly, for the 24-hour mode, it counted to 23.59 and then reset to 00.00. This scheme was adopted because of the apparent difficulty of resetting to 01.00.

At the time, we felt that the limitation was not serious enough to prevent publication of the article. Now, three readers have come to light with simple modifications to allow conventional operation, by permitting automatic resetting to 01.00.

Mr P. Hardy of Woomera, South Australia has evolved an elegantly simple modification which involves no extra components and uses one of the un-utilised NAND gates in the second 7400 guad NAND gate. Fig. 1 shows the circuit.

When pins 2 and 3 are both high, a 7490 will reset to a condition where outputs A, B, C and D (pins 12, 9, 8 and 11 respectively) are all low. This is decoded by the 7441 decoder / driver IC to provide an output at pin 16, which normally drives the zero digit of the appropriate numerical indicator tube. However, if pin 16 of the HOURS 7441 is connected instead to the numerical indicator tube cathode which indicates 1, then the clock will be effectively reset to 01.00, not 00.00.

Similarly, all other cathodes are moved to read one higher. This means that pin 15 of the 7441 connects to the "2" cathode instead of "1" and so on. Finally pin 2 of the 7441 connects to the "0" cathode instead of "9".

Since the HOURS output is now shifted by one step it is no longer possible to connect the output from pin 11 of the HOURS 7490 to pin 14 of the following "HOURS x 10" 7490, since the change of state indicating the zero condition for the HOURS 7490 occurs at a different time, ie, at the normal count of "nine" which has now become "zero".

To overcome this problem, a two-input NAND gate is used to detect the incidence of the new "zero" condition (pins 12 and 11 high). The output of the NAND gate is used to drive the "Hours x 10" 7490. The additional gate is one of the previously unused sections of the two 7400 quad two-input NAND gates used in the time-setting circuitry.

As with the original clock, the two 7490s driving the HOURS readouts may be wired to provide 12 or 24 hour operation merely by wiring in the links shown dotted on the diagram. For 12-hour operation, wire the dotted links marked 12 and for 24-hour operation, wire in the links marked 24. With the simple modification the circuit now counts to 12.59 or 24.59 before resetting to 01.00.

Another interesting solution to the resetting (from 12.59 to 01.00) problem was presented by Mr R. Kempton, of Herne Hill, Victoria. His circuit modifications are shown in Fig 2.

As with the previous circuit in Fig 1, the output of the HOURS 7441 to the numerical indicator tube has been shifted up by one for all digits, so that the "nine" output now corresponds to "zero". However the "Hours x 10" 7490 has now been deleted and is replaced by a 7400 quad two-input gate. This has been ingeniously interconnected to provide an RS flip flop (similar to that used in the time-setting circuitry) and the two remaining gates provide trigger pulses to the appropriate RS flip-flop inputs. It works as follows:

Since the "Hours x 10" 7441 only has to give a "0" or "1" indication (for 12-hour operation), pins 4, 7 and 6 are connected to the negative rail. These pins are normally connected to the B, C and D outputs of a 7490 decade counter. Pin 3 of the 7441 is connected to pin 8 (output of the RS flip-flop) of the 7400. If pin 8 is low, "0" will be indicated, if pin 8 is high, "1" will be indicated.

Suppose that initially pin 8 is low and zero is being indicated by the Hours x 10 readout. The HOURS 7490 counts through from 1 up to 0. When this happens, pins 11 and 12 of the 7490 go high and the NAND gate monitoring this condition drives pin 9 of the 7400 (one of the RS flip-flop inputs) low. This triggers the flip-flop so that pin 3 of the associated 7441 is driven high and "1" is indicated by the Hours x 10 readout. At the same time, the HOURS 7490 is reset to zero and recommences its count.

When the 7490 reaches 3 (according to our new code) the NAND gate monitoring the B output (pin 9 of the 7490) drives the other input of the flip flop low and flips the Hours x 10 readout back to "0". At the same time, the 7490 is reset to 1 and the process recommences. Note that in the second half of the cycle, 13.00 is not shown by the readouts — this condition is instantaneously reset to 01.00 as soon as it occurs.

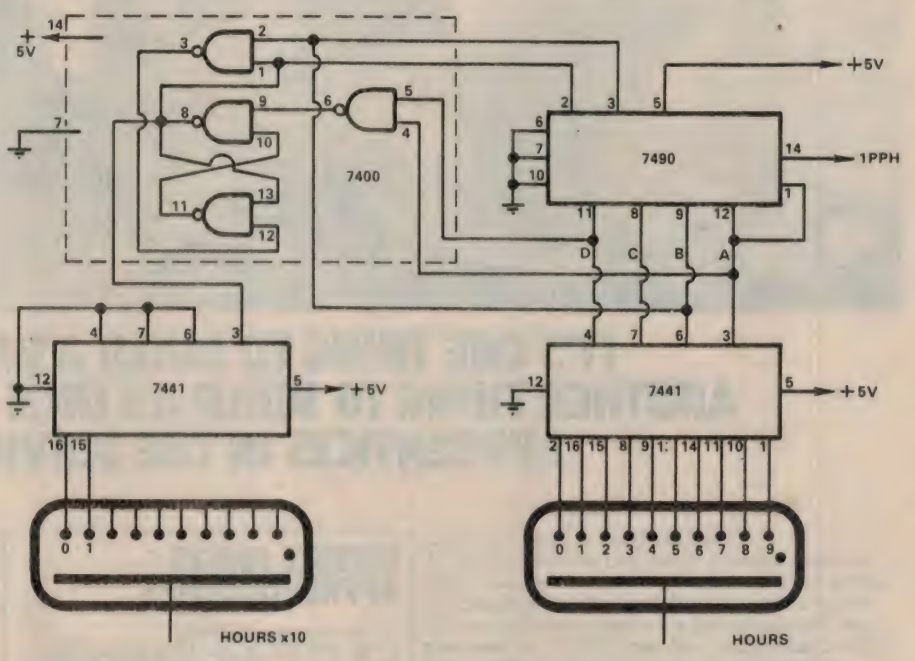

Fig 1. This modification allows conventional readout for 12 or 24-hour operation.

In its own way, this modification is also elegant and it has the advantage that it uses the cheaper 7400 device instead of a 7490. Against this, it can only function as a 12-hour clock. If 24 hour operation is desired, the circuit in Fig 1 must be used. Note that in Fig. 2 the "Hours x 10" 7441 is being used not as a decoder at all, but merely as a driver for the two readout tube cathodes.

A further suggestion has been made by Mr Kempton, as shown in Fig. 3. If the

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TSAP4.FP.63

time-keeping of the clock appears erratic it could be because of noise pulses "riding" the 50Hz mains-derived trigger waveform fed to the 7490 divider stages. The circuit in Fig. 3 acts as a pulse squarer to improve noise immunity. It uses two 7400 NAND gates, which may be already available if the Fig. 1 modification is used.

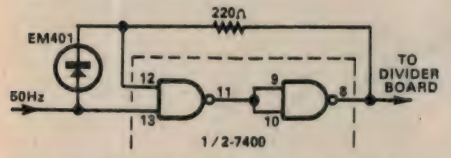


Fig 3: A Schmitt Trigger for the 50Hz input.

Last to present a circuit modification was Mr P. Tsui of Balaclava, Victoria. He has substituted a 7410 triple 3-input gate for one of the 7400s, and has eliminated one of the 7490 counters. The modifications are included in an abbreviated version of the June circuit shown in Fig 4.

Readers may recall that the "divide by 5" 7490 (first) in the divider chain has an unused flip-flop. This has been teamed with the "divide by 5" section of another 7490 to drive the HOURS 7441 decoder, using the original decoding system. The remaining flip-flop in this latter 7490 is then used to drive the HOURS x 10 7441 decoder. Only two output electrodes of this decoder, pins 15 and 16, are connected to the HOURS x 10 indicator tube. The rest can be left floating.

Operation is as follows: Consider the HOURS circuitry counting from 01.00 to 12.59. On arrival of another input pulse to the HOURS section, the clock attempts to indicate 13.00. However, the 3-input NAND gate monitoring pin 3 and 8 of the HOURS 7441 and pin 3 of the HOURS x 10 7441 immediately senses the HIGH condition of these pins. Its output goes LOW and the following NAND gate functioning as an inverter drives the reset pins, 3 and 2, of the 7490 HIGH and thus resets the flip-flops to zero.

The flip-flop connected to pin 3 of the HOURS decoder is not reset to zero. Consequently, the HOURS indicator reads 1 and the time indication is 01.00 instead of 13.00.

Perhaps this represents the neatest and most efficient of the three solutions to the original decoding problem, as it uses all available circuitry — there are no unused gates or flip-flops. But it has the drawback that it does not provide 24-hour operation. It also requires two long interconnections from the 1st 7490 in the divider chain to the HOURS circuitry.

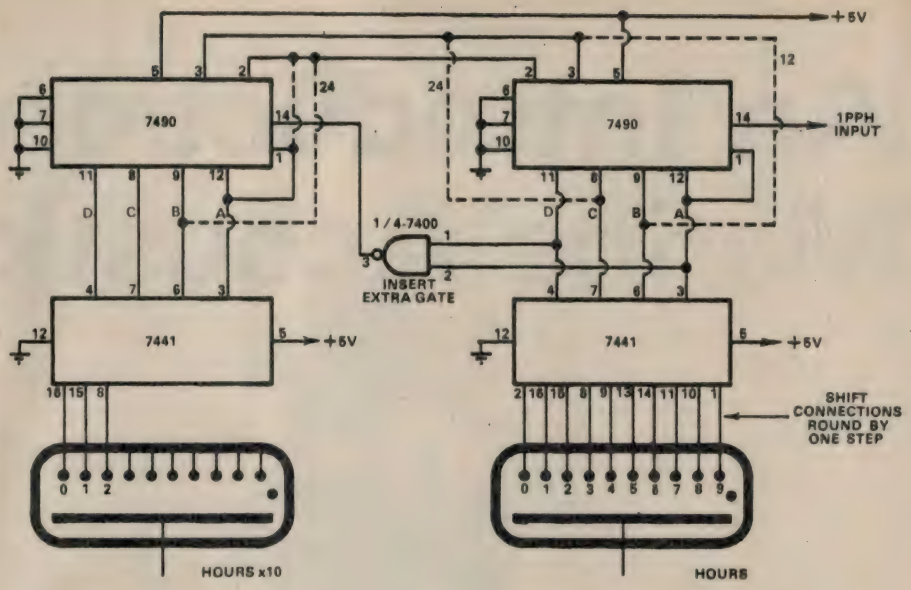


Figure 2: A decoding change and a flip-flop connected 7400 allow 12-hour readout.

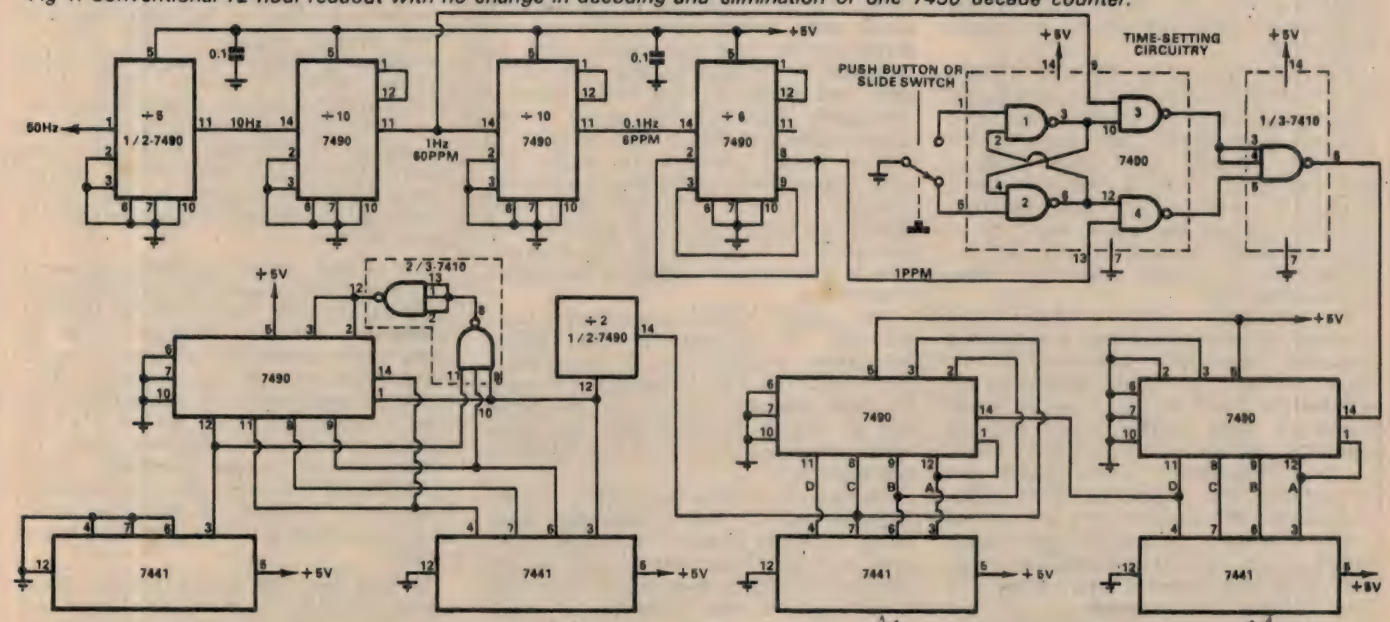
Several other modifications can be made to the clock circuit to improve its operation. First, the zener diode in the regulator circuit can be increased to a 5.6V device, BZY88/C5V6 and the associated resistor reduced to 220 ohms. As it is, the nominal 5V supply is a little on the low side. In addition, the HT rail can be filtered with a 4uF/300VW electrolytic capacitor to provide greater brightness from the readout tubes. The PIV rating of the diode should be increased to 600V at the same time.

Kitsets Australia Pty Ltd advise that they can supply the compact readout tubes used in the prototype. These are of Japanese origin and are brighter than some of the locally available tubes.

Doubtless there are more of our readers who have worked out equally ingenious modifications to the basic circuit featured in June and we are glad to have provided the initial stimulus. We appreciate the interest of readers who have written in on the subject. However, we regret we can devote no further space to this design.

In conclusion, we make note of several corrections to the circuit diagram published in the original article in June, 1973. First, pins 1 and 2 of the HOURS 7490 should be connected together. Secondly, the 1 PPM output from the "divide by six" 7490 should be taken from pin 8 rather than pin 11. Finally, two 0.1uF suppression capacitors were omitted. These are included in Fig 4 and are connected between the positive supply in the divider stages and the negative rail.

Fig 4: Conventional 12-hour readout with no change in decoding and elimination of one 7490 decade counter.



An Introduction to Marine Acoustics

PART TWO

In this second article of the series, the Author explains the factors which set a frequency limitation on underwater communications and shows the conflict between the useful transmission band and the concentration of marine noise. He discusses the various types of underwater transducer and indicates how a practical device can be contrived from a conventional magnetic earphone.

by J. D. PENROSE Ph. D.

(Physics Dept, West Australian Institute of Technology)

In the first article of this series a number of applications of marine acoustics were described and the importance of the refraction and reflection processes illustrated.

For many applications the way in which the sea absorbs sound and the background noise spectrum of the marine world must also be considered. For example, the recording and analysis of noises made by fish and crustaceans, a field now being explored by hobbyists and amateur scientists around the world, calls for an understanding of these topics, as does any attempt to use sound waves in a communications role.

The dominant feature of sound absorption in water, including sea water, is the strong frequency dependence observed. This is shown in Fig 1, where the absorption coefficient for sound is plotted against sound frequency. Both distilled water and sea water strongly absorb high frequency sound so that frequencies above about one megacycle are impractical for communication links of more than a few metres.

Low frequency, eg audio range sounds, however, are only slightly attenuated and so may be used to transmit information over long distances. An example of this was treated in the discussion on SOFAR transmission in the first article in this series.

Another example can be heard by swimmers in the vicinity of an outboard motor boat. The sound heard through the water can be quite loud, since water attenuates low frequencies less than an air path, and human hearing under water is reasonably effective. The sound is also much duller and flatter than that heard through the air link above the water. This effect can be striking if the boat to swimmer distance is about a quarter of a mile, illustrating vividly the way in which the sea acts as a low pass filter for sound waves, with preferential absorption of the higher frequencies.

Two major mechanisms have been proposed to account for the strong frequency dependence of absorption coefficient. The most important of these is the shear viscosity process, and the dotted line in Fig 1 indicates the absorption behaviour to be expected if this mechanism operates alone.

Fig 2a,b shows what is meant by a shear displacement. If the rectangular block being deformed is made of rubber, or indeed any solid material, it will behave elastically in this mode of deformation. This factor permits the formation of sound waves with transverse vibrations, ie in which particle movement is perpendicular to the direction of sound propagation.

For fluids such as air and water, the deformation of Fig 2b is not associated with any elastic reaction. Transverse oscillations are suppressed, leaving only the longitudinal mode in which particle movement is parallel to the direction of sound propagation. However, although there is no elastic reaction to the shear process of Fig 2 during sound propagation, viscous or frictional losses certainly occur.

Fig 2c shows how the deformation may be viewed rather as the similar movement of a pack of cards and shows how one card (or layer) needs to slide on another. This relative movement of adjacent layers of water uses up energy at a rate which is roughly proportional to the speed of the relative layer movement. Thus shear deformations, which are unavoidable, even in longitudinal mode sound propagation, use up energy in "rubbing" adjacent water layers together and these viscous energy losses increase sharply as the faster "rubbing" associated with high frequencies takes place.

The second major mechanism proposed to account for frequency dependent absorption has been the process of thermal conduction between adjacent areas of compression and rarefraction in the sound wave. That part of the medium which suffers a compression at some instant in time is heated, just as is the air in a tyre pump; conversely, adjacent areas of rarefraction are cooled. Inevitably, some conduction of heat takes place momentarily between the temperature difference areas and some energy is lost from the wave motion.

In practice, this second process is of lesser unimportance in a water medium and it remains true that the viscous drag

mechanism explains most of the features of the data in Fig 1. Curiously, the striking difference observed at 100kHz and below between sea and distilled water has been shown to be associated with the concentration of about 0.17 per cent of magnesium sulphate in the sea; it appears to involve a complex interaction between this compound and water molecules.

Overall, the absorption characteristics of the sea have restricted all but a few applications to make use of frequencies below 500kHz and most, including virtually all echo sounding gear, to 200kHz and below. Lower frequencies transmit well in the marine world and would be ideal for many purposes were it not for a direct result of their good transmission properties — that is, the prevalence of low frequency components in the background noise spectrum.

In other words, since low frequency noise propagates farthest, most noise recordings in the sea, other things being equal, will show a predominance of low frequency components. The kinds, locations, power output and spectra of marine noise sources will control ambient noise conditions.

Noise sources in the sea are of three main kinds — wave action, surface agitation and man-made noise. Fig 3 shows the main features of a typical noise spectrum measurement in the ocean. The main features shown are firstly the predominance of low frequency sound, mainly generated by oceanic turbulence. Waves control most of the spectrum between .01Hz and 1Hz and contribute some noise up to 10Hz. Water droplets, either from spray or rain, provide sound energy, while turbulent flow within the body of the sea and at the ocean floor adds further noise. Distant storms and seismic events may also be involved as low frequency sources.

Man-made noise, mainly ship noise, occurs in the middle of the spectrum and the hump shown in Fig 3 has been shown to depend strongly, particularly in North Atlantic waters, on the overall density of ship traffic in the region. The various lines in the high frequency end of Fig 3 are meant to indicate a dependence on wind and sea conditions near the measurement point and are largely due to surface agitation mechanisms, such as the droplet process already described.

Bubbles also play an interesting role in the noise spectrum. They are produced by wave action, fish, decaying matter and sea floor seepage. Also, atmospheric gas supersaturation can occur near the surface, with consequent bubble formation around nuclei. Overall, sea water will contain, particularly near the surface, a population of air bubbles, most of which are very small. These bubbles act as tiny resonators when any pressure disturbance strikes them and oscillate at their resonant frequencies, thus adding to the high frequency region of the noise spectrum.

Noise from marine animals and organisms, while not a large part of the noise level in the sea, has been given close attention, particularly to investigate possible communication behaviour and as a guide in developing fishing technology. Sound appears to play an important part in whale and dolphin behaviour and many non-mammals have characteristic noise patterns. Typical is the loud clicking of the snapping shrimp and the stridulation noise of the western rock lobster — a familiar sound to skin divers in search of a crayfish dinner!

Assessing the role of sound in the behaviour patterns of animals in the sea continues to be an intriguing research area and is one in which the conventional divisions between scientific disciplines are readily broken down.

Sound absorption behaviour and noise level results together provide two of the limiting factors associated with choice of operating frequency for many applications of marine acoustics. For example, the designer of a communications device of the type to be described in the third article in this series seemingly needs to choose a low operating frequency to give a long range link, yet a high operating frequency to avoid the noisiest part of the background spectrum!

Operating frequency choice also depends on the type and size of transducer available and this topic will now be considered.

The term transducer, properly used, applies to any device that converts energy from one form to another. In practice, it is often restricted to cases where the energy is associated with information transfer; it is certainly applied to the class of objects in marine acoustics which transform sound pressure to electrical voltage and vice versa. Three main mechanisms are in use in marine transducers; these employing magnetostrictive, electrostrictive and electromagnetic principles of operation.

Magnetostrictive transducers employ the effect familiar to many people in electronics, ie the tendency for a ferromagnetic material to change its dimensions as its state of magnetic induction is varied. A hard working TV line output transformer can often be heard whistling away, and suburban pole transformers can make their presence audibly noticeable. Many transformers and chokes working in the audio range can also be heard due to the action of magnetostriction.

Ferromagnetic materials such as iron and nickel have atoms which have unusually large magnetic moments, ie each atom is a minute magnet of considerable strength. The magnetic moments of adjacent atoms tend to interact so that the atoms group themselves together in minute assemblies called domains. In an unmagnetised sample, the directions of magnetisation of the domains are randomly oriented, though within each domain all of the atomic moments are parallel. When such a sample is placed in an external magnetic field, either the atomic moments within the domains line up with the field, or

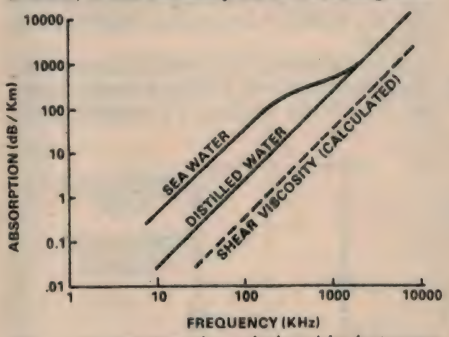


Fig 1: Illustrating the relationship between frequency and the absorption coefficient of distilled water and sea water. The difference apparently has to do with the chemical content of the latter. The dotted line indicates the likely level of absorption due to shear viscosity alone.

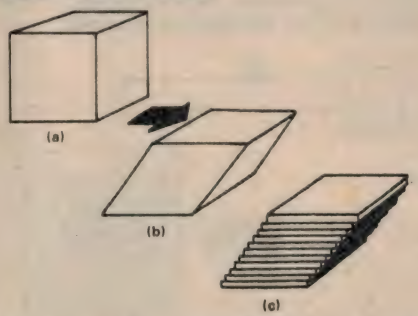


Fig 2: The phenomenon of shear displacement. A cube of "elastic" material (a) is deformed by shear stress as indicated in (b). With a non-elastic medium, such as water, the deformation or displacement resulting from shear stress is best represented by an array of sliding layers as in (c).

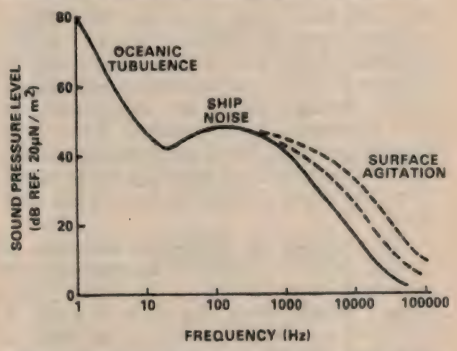


Fig 3: A typical plot of ocean noise level against frequency. The main sources of noise in the various frequency zones are indicated above the graph.

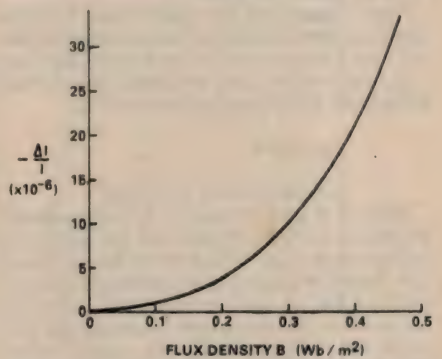


Fig 4: The strain versus flux density for nickel. Note that the change in length (delta l) does not bear a linear relationship with flux density.

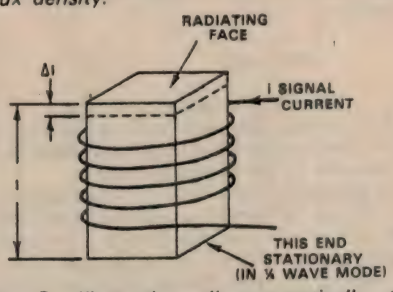


Fig 5: Illustrating diagrammatically the principle of a magnetostrictive transducer. The nickel core contracts by an amount delta l, because of the magnetic field produced by the signal current delta i.

Fig 6: Three common shapes for electrostrictive transducers, which change certain of their dimensions with the application of a signal voltage. They are analagous to capacitors.

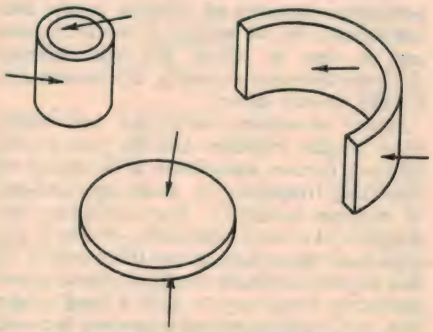


Fig 7: The transducers pictured in Fig 6 have metallised surfaces, as indicated above. They need to be polarised by one means or another to ensure a linear relationship between dimensional change and signal.

the domain walls grow so that those domains lined up with the field grow at the expense of the others. The movement of domain walls and atomic moments causes length changes which are independent of the direction of the applied field. The changes are positive in some materials and negative in others. An example of the latter is nickel which shrinks on application of a field.

Fig 4 shows the fractional decrease in length, delta l / l, plotted against applied magnetic flux density B in Webers per square metre. From the point of view of acoustics use, the important parameter is delta l, ie the total change in length for a given piece of nickel. This will control the amount of movement a nickel transducer is able to apply to the sea water in contact with its radiating face.

Fig 5 illustrates the contraction brought about by the influence of a magnetic field B produced by current in the energising coil.

As Fig 4 shows, the relationship between delta l and B is of square law form, ie

$$\Delta l = C_1 B^2 \quad \ldots\ldots 1$$

where C1 is a constant.

Since B is proportional to i, a transducer as shown in Fig 5 would not be linear; it would not give an output sound wave which was linearily related to some signal current i but rather to current squared. For this reason, magnetostrictive transducers are subjected to an additional fixed value polarising field Bo which is either provided by permanent magnets or by a direct current component in the energising coil. In any case, the displacement, delta l, is now given by:

$$\Delta l = C_2 B_o B \quad \ldots\ldots 2$$

where C2 is another constant.

The device, now said to be polarised, is now linear, since delta l is proportional to B and hence to the signal current i.

In practice, magnetostrictive transducers are laminated to reduce eddy current losses but even so are essentially restricted to the range 10kHz to 60kHz although applications to 100kHz have been made. They have been widely used in echo sounders and are often actuated, in the transmitting mode, by a simple spike pulse and allowed to ring at their resonant frequency.

Electrostrictive devices have the widest range of application of the three classes. All dielectrics exhibit electrostriction, but the effect is only sizable in a class of materials called ferro-electrics which are directly analogous to the ferromagnetics. Within ferroelectric materials, electric dipoles are formed spontaneously and aggregate into domains which, under the influence of an electric field, adjust their size and position and cause small changes in the physical dimensions of a sample.

Ferroelectrics, like ferromagnetics need polarisation in order to function as linear transducers but in the ferroelectric case, this is readily done during manufacture so that no external polarising field need be applied.

If ferroelectrics are heated above their Curie temperature, all the electric dipoles are disordered but may be aligned in any direction within a heated sample by applying a strong electric field in that direction. When cooled with the field still applied, the sample retains this "frozen in" polarisation and is then linear. Samples can be made in almost any form and are of a ceramic nature.

Fig 6 shows a collection of common electrostrictive transducers and Fig 7 indicates where metallised surfaces have been applied to make the contacts. Since the ferroelectric material, often barium titanate or, more recently lead zirconate titanate (PZT) is a dielectric, the addition of these metallised contact surfaces effectively turns these devices into capacitors as well as transducers. This factor needs to be kept in mind when connecting an electrostrictive device to circuitry.

Since the electrostrictive device is both a capacitor and a mechanical oscillator, it is difficult to visualise how to connect it to, for example, a continuous wave oscillator so as to obtain maximum power transfer from oscillator to transducer and into the sea water. One wants to know what output impedance to choose for the oscillator unit.

This question can be answered quickly on the bench by making a direct measurement of the transducer impedance. Consider an example, involving a disk transducer of the kind shown in Fig 6 and 7 immersed in water. This was arranged as in Fig 8 and its impedance determined at various frequencies by comparing the voltage across the transducer with the voltage across the known resistor.

Fig 9 shows the way in which transducer impedance varied with frequency around a dominant dip in the curve associated with "half wave resonance" of the sample. This is the simplest mode of oscillation of the flat disk and is illustrated also in Fig 9. The transducer should be operated at this frequency in order to transmit maximum power into the water. Provided this was done, the transducer concerned presented an impedance of 44 ohms to the driving circuitry. The mounting and encapsulation necessary to protect it in the marine world would be expected approximately to double this figure.

These results are more easily understood if the equivalent circuit of the device is considered. This is shown in Fig 10 where the mechanical oscillator function has been converted into an analogous electrical circuit. This is made up of an inductor L, analogous to the oscillating mass elements of the transducer, a capacitor C, analogous to the elastic properties of the transducer

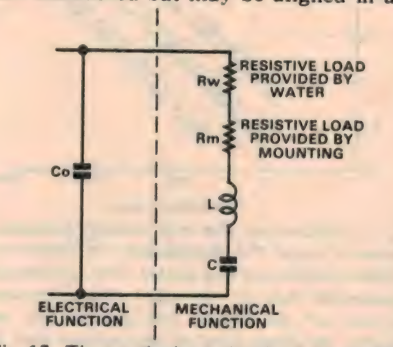


Fig 10: The equivalent circuit of an electrostrictive transducer. Best examples of the device are the ferroelectric materials.

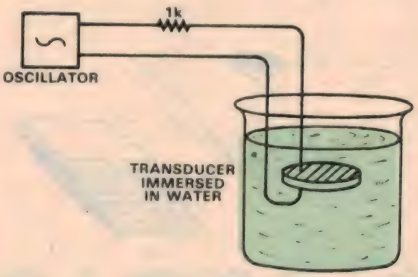
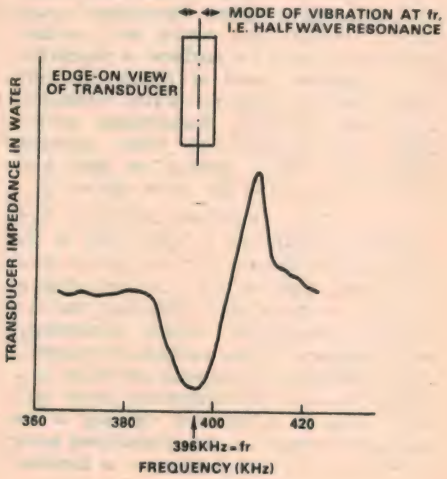


Fig. 8 (above): The impedance of a transducer can typically be assessed by operating it in the laboratory in a container of water.

Fig 9 (right): The impedance curve of an electrostrictive transducer in water. The transducer area was 5 square centimetres and thickness 5 millimetres.



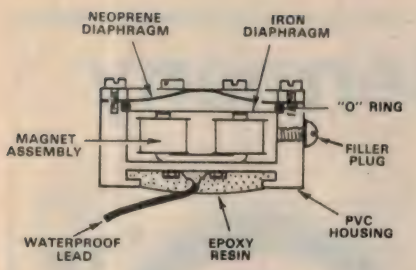


Fig 11: A practical transducer for underwater use can be made up from a magnetic earphone, as indicated here and described in the text.

and two resistive elements Rm and Rw which represent vibrational losses into the mounting and the water.

The analog circuit of the mechanical oscillator has the resonance seen in Fig 9 at:

$$fr = \frac{1}{2\pi\sqrt{LC}} \quad \ldots\ldots 3$$

At this frequency maximum energy is dissipated into the resistive elements and thus into the load Rw.

However, the transducer is still a capacitor (Co) as well and Co, as shown in Fig 10 shunts the mechanical oscillator. For continuous operation at fr, Co often has an inductor Lo connected across it chosen such that:

$$fr = \frac{1}{2\pi\sqrt{LoCo}} \quad \ldots\ldots 4$$

The combination of Lo and Co then forms a rejector circuit which offsets signal losses through Co.

Electrostrictive transducers are used in a wide range of marine applications including sonar, some echo sounding and passive listening uses. Generally, single element transducers are not very efficient at low frequencies although many have been used, together with suitable amplifiers, in experiments to monitor fish noises.

In any marine use, lead connection and transducer mounting and encapsulation need to be carefully done. Leads must be connected to the metallised surfaces of the type shown in Fig 7 and this may be done in one of three main ways: Carefully arranged mechanical clamping can be used if good contact is assured but this adds to mounting losses. Leads may be glued using, e.g. conducting Araldite or may be soldered using a silver bearing solder. In the latter case, care should be taken not to overheat the transducer and exceed the Curie point which, in barium titanate is about 120 C.

Generally, glued or soldered leads cannot be expected to have a load bearing role and separate mounting arrangements must be made. These often take the form of casting or encapsulating the device in an epoxy resin which should ideally have similar acoustic properties to sea water. In practice, most casting resins will be satisfactory provided the transducer is not coated too thickly.

Fig 12: A typical underwater electromagnetic transducer, constructed on a handyman basis, around magnetic earphone components.

Space does not permit a detailed discussion of electromagnetic transducers, which have the particular advantage of high output in the audio range but Fig 11 illustrates how a workable underwater electromagnetic earphone may be constructed from an old headphone. The headphone is mounted in a waterproof PVC housing filled with alcohol or brake fluid. Thus the unit contains no airspaces and will not collapse under water pressure. The fluid in the housing loads the diaphragm considerably and it is usually necessary to rewind the coils of the electromagnets if low voltage signals are employed. Some variation in frequency response of the unit can be achieved by this process and also by drilling vent holes in the diaphragm. Fig 12 shows the completed unit.

In the third and last article of this series, some of the techniques described here will be applied to several interesting underwater projects.

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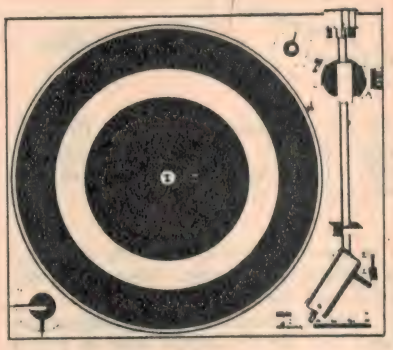

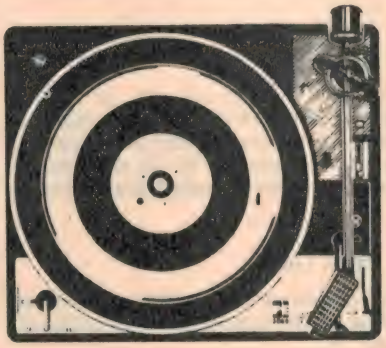

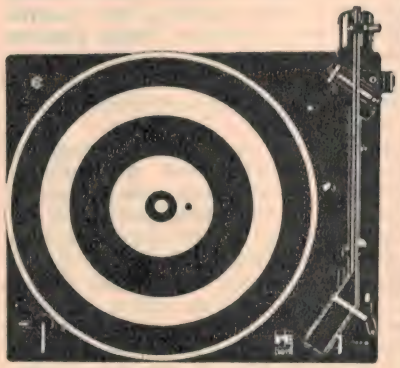

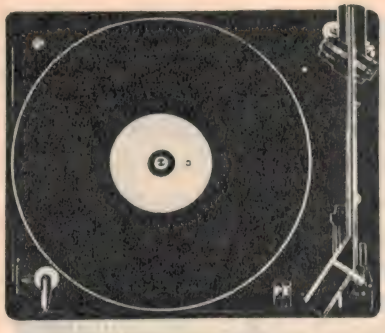

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by LEO SIMPSON

Every day, many scenes are unfolding before our eyes. Our whole world is changing: buildings are erected and demolished, landscapes change, plants grow and die; large numbers of people move from place to place; the weather changes continually and the sun rises and sets.

Trouble is, we seldom really see these things happening. Many of them happen too slowly for us to appreciate them — or to put it another way, our lack of concentration means that we don't bother to watch them. We rarely have the time just to watch a complete sunrise from the first glimmerings of dawn until the sun is fully risen, nor do we have the time to watch and appreciate all the other changing aspects of the world around us.

Seen in this light, time-lapse photography represents a very worthwhile challenge to the movie hobbyist. As well as presenting a lot of technical problems, it provides interesting, educational and often funny film sequences. For example, if we were to take a film of people entering and leaving one of Sydney's railway stations during a peak period and compress it to last just a few minutes, we would have a very funny and convincing demonstration of the ant-like behaviour of people.

Whereas normal motion pictures are produced at the same frame speeds used for projection, from 16 to 25 per second, time-lapse movies are produced at lower frame speeds to suit the subject. For a flower opening when it is exposed to daylight, we might use one frame per second exposure; for a plant growing, we might use one frame every hour. After the film sequence is processed, it is run through the projector at the normal frame speed, producing a resultant speed-up in motion.

Some of the more expensive movie cameras for home use have variable frame speed from one frame per second upwards. Other cameras have a socket for a standard shutter release cable to enable single frames to be exposed at whatever rate the user requires. So unless one has the former type, the simplest way of doing time-lapse movies is to set the camera up on a tripod and periodically press the shutter release cable every second, minute, hour or whatever. But as well as being the simplest method, it is also the most tedious.

Our approach to this problem has been to develop a timer circuit which periodically closes a relay, whose contacts may be used to operate the camera at the required intervals. The timer intervals are adjustable in eleven steps from one second to twenty minutes (longer time intervals can be arranged). That takes care of the time intervals, but two problems remain.

Lighting is the first problem. If you are exposing film over a period of time it is unlikely that the lighting will remain constant. In many cases artificial lighting will have to be provided, and this poses the question of whether floodlights or electronic flash will be used. If floodlights are used, provision must be made to ensure that they are fully on before each exposure and switched off or down afterwards; if electronic flash is used, provision must be made for correct synchronism of flash and shutter.

The second problem arises because few movie cameras have provision for remote electrical triggering of the single-frame function. Those few cameras which do have this provision will mate with the trigger unit very simply, but with the majority of cameras it will be necessary to provide some sort of mechanical actuator between the two, to operate the single-frame shutter release. The most likely choices would be either a solenoid or a small motor, energised in each case via the relay contacts provided on the trigger unit.

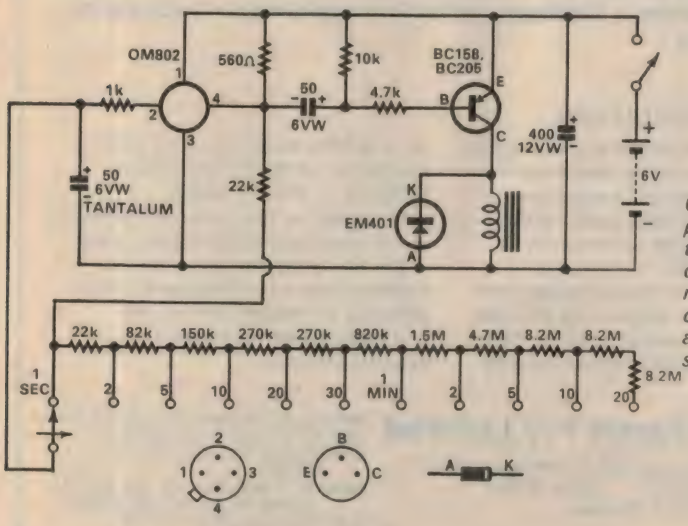
We must stress that you should solve this problem before you start to construct the trigger unit itself, for the fairly obvious reason that without a suitable actuator, the trigger will be virtually useless.

When developing this project we could not obtain a suitable low-voltage solenoid to operate a shutter release cable. Some readers may be in a position to have one made or make it themselves. But this is not an easy task, as the solenoid must have considerable thrust yet be reasonably economical in terms of current drain.

An easier approach is to obtain a 12V automotive windscreen wiper motor and linkage system from a car wrecker's yard. You will need one which automatically "parks" the wipers when they are turned off. This type has a cam-operated pair of contacts on the motor which can "hold" and "break" the circuit every revolution of the gearbox output shaft. The gearbox is enclosed in the motor housing.

Current drain of the motor will be of the order of a few amps, depending on the type. It should be possible, considering the proposed intermittent operation of the motor, to run it from a pair of 6V lantern batteries connected in series to provide 12 volts. The wiper linkage system will have to be adapted to operate the shutter release cable, but this should not be too difficult for those with a reasonable degree of mechanical skill.

In operation, the timer relay will energise the motor for about a half-second, following which the motor contacts should take over to maintain the circuit for one revolution of the output shaft.



Circuit at left has few parts but provides time intervals from one second to 20 minutes. Relay operating time is about a half a second.

EA AUTO-TRIGGER 2/PT/7

COPAL Model 801

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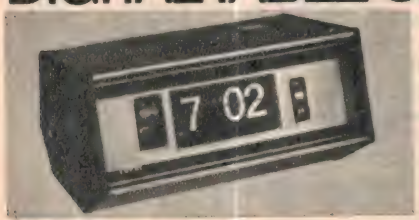
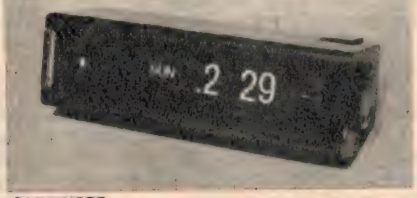
A range of eight electric mains, or battery operated, digital table clocks is available in both calendar and alarm models—12 and 24-hour types. Illustrated below are the 702 and 229 models.



Model 702
Electric luxury alarm. Extruded aluminium case in bronze or gold. Neon illuminated. Seconds indicator graduated each five seconds. Snooze alarm.



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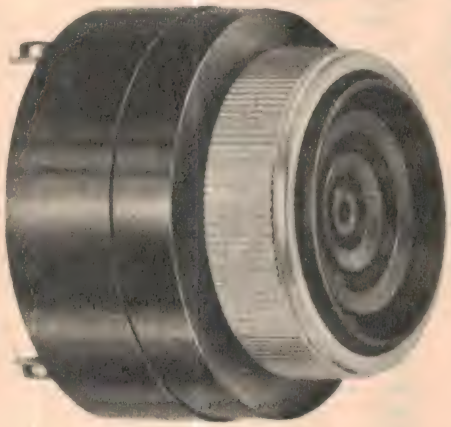

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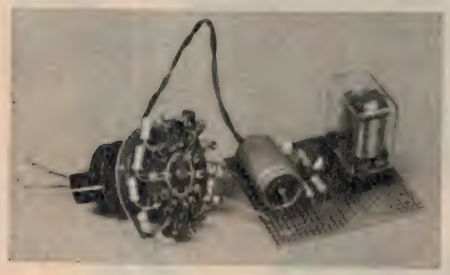
AC90

We must stress that we have not tried this approach. It is only a suggestion, but one which we think can be made to work with the application of a little ingenuity.

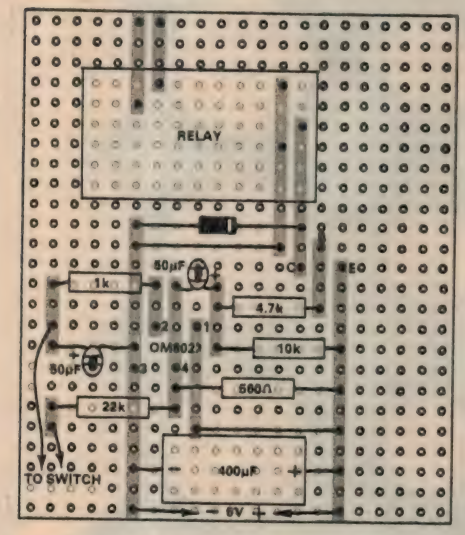
Having worked out a solution to the drive problem, the timer circuit can be built. It is a simple module, containing one integrated circuit and one silicon PNP transistor, together with a relay and a handful of minor components.

Heart of the timer is the Philips OM 802, which is a new monolithic integrated circuit primarily intended as a low frequency relaxation oscillator. Its main advantage is a very low triggering current, which enables the provision of very large time constants with modest capacitance values. Putting it another way, it is possible to obtain large time intervals with modest capacitance values and large resistors.

Maximum supply voltage rating of the OM802 is 12V, so we have designed the circuit to suit a 6V rail. The basic relaxation oscillator circuit consists of only one 50uF / 6VW tantalum capacitor, 14 resistors and the integrated circuit. The OM 802 comes in a four-lead metal TO-18 package, identical in appearance to the silicon RF transistor BF115.



Above is the prototype trigger module and below is the wiring diagram.



Referring now to the circuit diagram, the output at pin 4 of the IC is normally high, so that the 50uF capacitor charges toward the positive supply rail via the 560 ohm resistor and the timing resistor string wired around an eleven position switch. When the voltage across the capacitor rises above the threshold voltage set by the internal circuitry of the IC, the capacitor is discharged and the output at pin 4 drops to almost zero, applying 6V across the 560 ohm resistor. When the capacitor is discharged the cycle repeats, continuously. The 1k resistor provides current limiting during the discharge time into pin 2.

It is possible to connect a relay, shunted with a diode, in place of the 560 ohm resistor and this would result in a very simple timer circuit. However, the time for which the output at pin 4 is low depends on the overall time constant of the circuit. For example, for a timer interval of 5 seconds, the output pulse may last for about one second whereas for a ten minute interval the output pulse may last several seconds.

If the timer was used to drive a solenoid where the time of power application was not important it would be acceptable, although it would be wasteful of power. If it was used to control a motor, however, power would be applied for longer than required for one frame exposure, which would mean that several frames were exposed instead of one.

This problem has been solved by adding a single transistor stage with a differentiating RC network in the base circuit and having the relay as collector load. It works as follows: When the output of the integrated circuit (pin 4) drops to zero, the 50uF capacitor in series with the base of the PNP transistor charges via the 4.7k resistor and the 10k resistor which is effectively in parallel. This turns on the transistor and it closes the relay. When the capacitor is charged to almost 6V the PNP transistor turns off, since its base current is provided solely by the capacitor. When the output at pin 4 rises the capacitor discharges via the 10k resistor, so that the cycle can be repeated at the end of the next timing period.

A diode in parallel with the relay protects the transistor against the voltage spike generated by the relay when the transistor turns off.

Timing resistors have been selected to give a 1,2,5,10 sequence of increasing time intervals. The longest time interval provided is twenty minutes in the prototype, but this may be increased to an hour by using a bigger timing capacitor(s). The timing capacitors must have very low leakage, which confines the choice to plastic dielectric or tantalum capacitors. We used tantalum because they are small and cheap where large values are concerned, but you could use plastic types if your pocket can stand the strain, and your case is large enough to accommodate them.

The relay we used is an STC type 250 GDO, which has a 52 ohm coil and two sets of changeover contacts. If other relays are used the circuit should be redesigned so that the relay closes for about ½ second.

Average current drain of the circuit is very low and can easily be provided by four penlite (1.5V) cells connected in series in a standard penlite cell holder. A 400uF electrolytic capacitor connected across the supply is included to ensure a low output impedance from the batteries, particularly when they near the end of their service life. Service life should be almost equal to the shelf life in view of the intermittent mode of operation.

Construction is straightforward, and layout is non-critical. The prototype was built on Veroboard. This has the advantage that it can be made to take the relay socket by opening up some of the holes slightly.

The circuit may also be made to operate as a "one-shot" delay switch, by connecting the 22k resistor presently shown connected to pin 4 of the IC to the positive supply rail instead. But note that the time delays obtained will be different from the time intervals obtained when the unit operates as a relaxation oscillator.

So there you have it — a simple little trigger unit which is capable of allowing you to make a wide range of interesting time-lapse movies. But let us again stress that you should make sure you have solved the problem of actuating the camera's single frame release, before you invest in parts for the trigger.

PARTS LIST

1 OM 802 integrated circuit (Philips)
1 BC158, BC205 silicon PNP transistor
1 EM401 silicon diode
1 400uF / 12VW electrolytic capacitor
2 50uF / 6VW tantalum capacitors
1 250 GDO relay (STC) and mounting socket
1 eleven position rotary switch

RESISTORS
(5 pc tolerance, ¼ or ½W)
3 x 8.2M, 1 x 4.7M, 1 x 1.5M, 1 x 820k, 2 x 270k, 1 x 150k, 1 x 82k, 2 x 22k, 1 x 10k, 1 x 4.7k, 1 x 1k, 1 x 560 ohms

MISCELLANEOUS
Drive system for shutter release, Veroboard, hook-up wire, batteries, knob, solder.
Note: Components with higher ratings than those specified may generally be used provided that they are physically compatible. Components with lower ratings may also be used in some cases provided the ratings are not exceeded.

There's more to mid-range frequencies than meets the ear.

The graphic illustration below represents the typical frequency response expected in a good hi-fi system. A large proportion of the sound can be classified as mid-range and to hear this sound at its best a well engineered mid-range speaker is essential.

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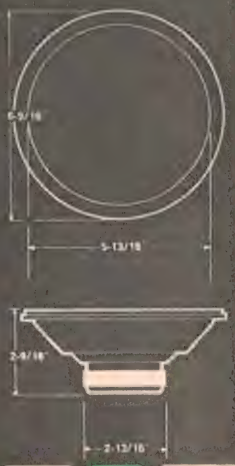
Full application notes are available from Plessey Rola distributors or Plessey Rola direct.



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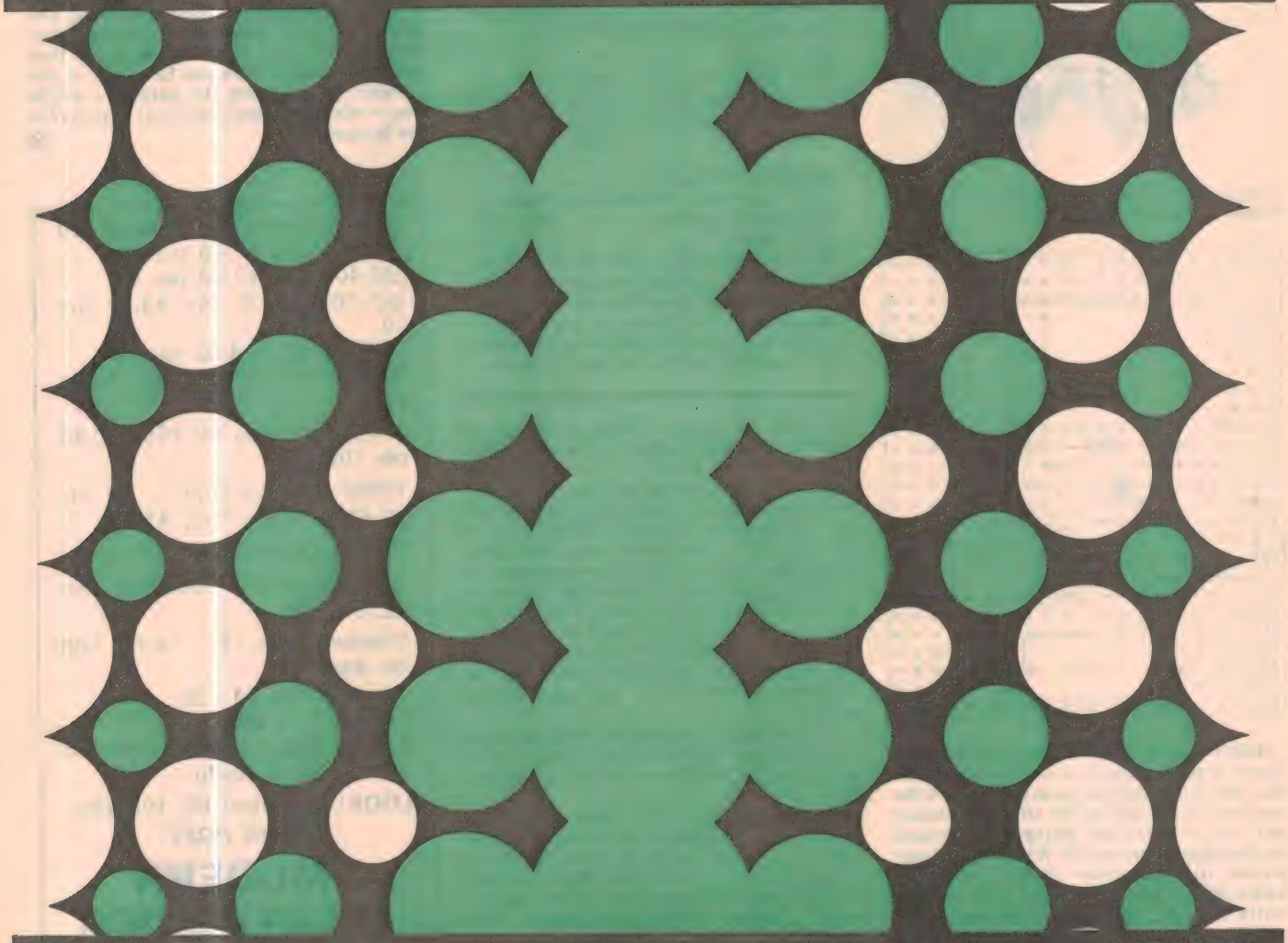
C6MR Mid-range

Frequency response 450 Hz to 6600 Hz
Voice coil impedance 8 or 15 ohms
Power Handling 20 watts RMS with recommended crossover
Speaker Diameter 6-9/16".



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AR 54

FORUM

Conducted by Neville Williams

Enlarger Timers: What is a "half-stop"?

The solid-state photographic enlarger timer described in our May issue was a conventional, no-nonsense project yet, strangely, it stirred up more than its share of controversy — together with some resulting discussion in our own office. Perhaps other readers have had similar thoughts, without actually committing them to paper.

The first, and most elaborate, challenge was from a reader in Tasmania, who we will not further identify, because he has since retracted his statements at the instigation of his own son. It's a bit rough on Dad, when the young bloke sets you right technically!

This particular reader looked at the time intervals we had provided in our timer and jumped to the conclusion that the progression we chose (1, 1.4, 4, 5.6, 8 . . . seconds) had been based on stop numbers, as marked on the lens adjustment of cameras and enlargers. Certainly the number sequence is the same.

On this assumption, we appeared to have made a fundamental error, as follows:

In a lens mechanism it is conventional to arrange matters so that the exposure is progressively doubled or halved as the lens is clicked through its stop settings. In line with this, the stop settings are arranged so that they progressively double or halve the area of the aperture through which the light passes.

However, in defining lens characteristics and settings, use is made of the ratio: focal length to diameter NOT focal length to area. Between area and diameter there is a square law relationship, so that 2:1 area ratios become (root 2): 1 diameter ratios.

As a result, stop numbers on lenses follow a root-2 progression (1.414); each time the diameter is increased or decreased by this figure, the area (and hence the light admitted) doubles or halves.

However, the aforesaid Tasmanian reader noted that there is no square function in exposure time. He reasoned that, if you increase the exposure time in an enlarger from 1 to 1.4 seconds, you increase the effective exposure by the same ratio. You are not doubling it as you would do, if you clicked the lens from 1 to 1.4.

This made it look as though we had confused time and area. More than that we had made the same apparent mistake in an earlier timer described in August 1964. To quote our critic: "the concept of half-stop in aperture is confused with the concept of a half-stop in time."

Determined to put the record straight, our Tasmanian reader produced a complete article entitled "Solid State Phototimer — More About Time Intervals."

In careful, well-written prose, he explained about apertures, aperture numbers, "size of the hole," stop numbers and so on. He showed that, to double exposure in terms of time, it was necessary to use ratios of 2:1.

So far, so good.

He then made the point that, for close control of exposure, it was desirable to provide a facility whereby the exposure time could be increased or decreased by "half a stop." He went on to work out a revised switching system to provide "half-stop" exposure times which would be halfway between the whole numbers of seconds. These would replace the 2/5 intervals which we had apparently happened upon in wrongly applying stop numbers.

His "ideal" series would read 2, 3, 4, 6, 8, 12, 16 seconds and so on.

And here, unknowingly, he had ended up in very muddy water.

First of all, we had not confused aperture and time in either this or the earlier article. In the May 1973 article, par 3 defines the time series as a geometric progression. It states specifically that each step on the timer is equivalent to "half a stop" on the camera lens and that the timer has to be clicked through two positions to double the exposure.

Our correspondent apparently jumped right over this in his haste to put paper to typewriter!

But, having assumed that our 1.4 series was the result of a mistake, he rejects it as having any claim to a "half-stop" equivalence. Instead, with somewhat greater effort, he comes up with a substitute series. But alas, the new series doesn't stand up to examination.

Starting with 2 seconds, the next interval is 3 seconds. Superficially that's fine: an increment of 50 pc.

But, starting at 3 seconds, his next interval is 4 — an increment of only 33pc.

Perhaps the series should run: 2, 3, 4.5 etc. But then, nowhere, does one get a 2:1 interval.

In short, what is a half-stop in terms of exposure time? Is it a valid term or can it be at best only an approximation? These were the questions we found ourselves re-examining.

In fact, a little thought will show that a cumulative 50pc series is no more practical in terms of area than it is of time. Mathematically, the only series which can be cumulative and which will fit into existing 2:1 intervals is a root-2 series.

Therefore, whether talking in terms of lens area or exposure time, half a stop can only mean an increase or decrease of 1.414. The casual definition of half a stop as a 50pc increase is wrong.

You will note that we used quotes in the May issue around the term "half a stop." There have been arguments before in these columns about the use of quote marks but let's say they signified, in this case: "what some people refer to as half a stop."

Fortunately, our rebuttal of the criticism was little more than a formality. By the time it was received, the correspondent's son had come across an article in the July 1964 issue ("Design For A Photo-Timer" by Philip Watson) setting out the reasons for the choice adopted in both the instruments

An injustice to genuine stockists?

Dear Sir,

I read with interest the Editorial in the June issue of "Electronics Australia." In it Mr Rowe states "to be honest I believe that some of the component suppliers and self proclaimed wholesalers are themselves responsible for a certain proportion of the part supply problems experienced by our readers."

As a large quantity stockist of a small range of specialised components (as used in "Electronics Australia" and "Electronics Today" projects) I would thoroughly agree. However, in a following paragraph you state "(they) are not adverse to telling the would be constructor that the parts we have specified are not made or not available."

I only hope in writing this sentence, you realise its implications. Every week we have to advise some clients that certain parts they have ordered are "not available."

We have no doubt that many customers will now be thinking that we (and several other reputable mail order companies) may be one of the "self proclaimed" wholesalers you are referring to. You offer no advice in your editorial as to how a constructor can judge what he is being told is the truth by the supplier, and your magazine does not list reputable suppliers so that the constructor can lean on your "inside knowledge" of the industry.

We believe that not only are the component suppliers and "self proclaimed wholesalers" responsible. When compiling our 1973 catalogue we included three "Electronics Australia" Publications on the understanding that we would be able to obtain continuous supplies.

At the present time only one publication ("Fundamentals of Solid State") is available. This means that every customer ordering the other publications receive an advice note stating "not available at present."

No doubt your editorial will place a firm doubt in their minds as to whether to believe us or not.

Yours faithfully,

R. H. Smith, M / Director

Dick Smith Electronics Pty Ltd.

FORUM

subsequently described. Let's quote just three pars:

"It seemed that what we wanted was a scale in which every step would represent a change of 1.5 times and ideally, every second step a change of two times. But such a scale is virtually impossible if every step is to maintain the correct relationship to its neighbours. For example, a setting of 1.5 seconds multiplied by a factor of 1.5 gives, not two, but 2.25.

"But the factor did not have to be exactly 1.5. It could just as easily be 1.4. And 1.4 times 1.4 (1.414 more correctly) is two. Working on this basis we produced a scale having some unique features.

"The figures on the resulting scale bear a striking resemblance to the figures on the diaphragm of your camera, but this is more coincidence than anything else, and the two meanings must not be confused. Stop numbers represent a doubling of exposure, because increasing the lens diameter 1.4 times doubles the area of the lens in use, and thereby doubles the light falling on the film. On the other hand, increasing the exposure time by 1.4 only increases the available light 1.4 times. In the first case the increase is a square function, in the second a linear function."

It all ended happily. Guided by the July '64 article our correspondent redesigned the circuit to provide intervals based on the cube root of 2. This gives him the closer intervals desired while still giving him a doubling of exposure time with every third switch position.

Another letter on the same subject came to hand from P.S. of Thornbury, Victoria. This correspondent did not question our basic circuitry but, seeking closer intervals, he had modified it to produce what he refers to as one-third stop adjustments of exposure. Reference has been made to this letter in "Circuit Design Ideas."

The same letter describes a further modification, whereby exposure can be controlled by a cadmium-sulphide cell reacting to the total light reflected from the printing paper.

I must confess that the first sight of this suggestion caused me to over-react and to ask audibly who was kidding whom? Side by side on the one circuit the contributor had provided for very small increments of exposure, and then an automatic form of control which is just about as unrefined as one can get.

Perhaps the over-reaction can be excused by the number of times automatic total-light measurement is "discovered" and advanced as being the answer to the hobbyist's prayers.

Closer reading of the letter indicated that P.S. did understand the situation and that his enlarger light timing system had been contrived to cope with a variety of uses, including mass production of prints. As such, it probably works fine, but the juxtaposition of nominal one-third stop intervals and a total-light control system did look odd — rather like a tradesman turning up on a job with a micrometer and his wife's tape measure!

The point about a total-light system is that it responds to the total light passing through a negative (and on to the printing paper). It adjusts the exposure to produce a print in

which highlights and shadows average out to a certain predetermined "greyness" for the total print area.

From an "average" negative, an "average" print may indeed be quite acceptable, but there is more to it than that.

If a subject happens to be standing against a predominantly dark background, the automatic system tends to increase the printing time in an effort to bring the predominantly dark picture up to the "average" grey; in the process the subject's face will be blanched.

Conversely, in a ski setting, the automatic system will react to the abundance of light, decreasing exposure time and producing a black-faced subject against a background of grey snow!

For these reasons, one would expect provision for very close control of exposure time to be coupled, not with an averaging system, but with a sophisticated light probe enabling highlights and shadows to be examined selectively.

It is for similar reasons that total-light exposure measurements are losing favour in modern high quality cameras. The manufacturers have come up instead, with various schemes which react more selectively to individual sections of a picture.

Even then, camera manufacturers do no more than provide whole stop increments for taking pictures. Whether intervals closer than "half a stop" are justified for processing those pictures might be another area for debate.

And there we'll leave it.

THE PARTS SITUATION

Changing the subject, we reprint on the preceding page, a letter from one of our regular advertisers, Mr Dick Smith. He is concerned lest the editorial in our June issue reflects unfairly on those stockists who are genuinely trying to give service to the users of electronic components.

A number of other suppliers expressed a similar view in personal conversation or by telephone. They point out that a lot of capital is involved in carrying substantial stocks and, in the face of admitted supply problems, they are keen that credit be given where credit is due.

Fair enough.

I must point out, however, that the editorial was not just about stockists. It was concerned with an overall shortage of components so serious that major manufacturers around the world are affected, with delivery times being quoted as long as 60 weeks. Reference was made to a long priority queue in which Australia and Australian enthusiasts have to take their place.

This should surely support rather than erode the credibility of genuinely concerned suppliers who have to tell their customers that stocks of certain components are not immediately available.

(Dick Smith names us as a co-offender because we have run out of stocks of two of our handbooks. Yes, we underestimated the demand and the time it would take to reprint or replace. But that doesn't alter the picture in regard to components.)

As part of the overall picture, Jim Rowe did make the point that some parts suppliers aggravate the position by trying to work from inadequate stocks, or no stocks at all. When the inevitable delays occur, they blame anybody but themselves.

We know that it happens because we talk with all parties, purchasers, suppliers and manufacturers (or agents). Concerning this matter Dick Smith says "I thoroughly agree." However, he goes on to ask how purchasers are to identify the "good" firms from the "not so good" ones.

Frankly, I don't think there is a simple answer to this. Dick Smith is proud of his stocks but he admits to having to advise customers from time to time that he cannot immediately fill their orders. And even if he headed a list of recommended suppliers, there would inevitably be complaints that "I ordered a thingamy from the firm at the head of your list and I'm still waiting!"

And such is the perversity of circumstance that a firm not listed would have the very thingamy that no one else seemed to be able to get!

Frankly, I think that one discovers good suppliers in much the same way that one discovers good doctors, good mechanics or good estate agents. You ask, you observe, you try. You reject the obviously inadequate or obviously suspect and choose ultimately the one that seems to give you a satisfactory service.

That's the very core of successful business.

The simple fact is that component suppliers are an essential link between a journal which specialises in constructional articles and a very large group of readers with an urge to build and experiment.

In an effort to ease the supply position we plan, in future issues, to publish a representative list of firms which deal directly with the consumer and which stock a range of components suitable for our projects.

We suggest you give them your support.

SUPPORT FOR CDI

Dear Sir,

With reference to your reply to F.S., in May E.A., I have discussed the matter of CDI with an RAA (SA's counterpart to the RAC) patrol. He stated that he understood that tests on a dynamometer did not show any increase in hp with CDI. That, however, is only part of the story.

The patrolman spends a lot of his time starting cars which won't start in the winter or in rain. He considered that about 50 per cent of these cars could have been started by their owners if they had had CDI. In other words, although it doesn't improve the performance of a well maintained car, CDI would be a benefit to those which are troublesome to start and this applies particularly to cars with automatic chokes. He named several makes which are characteristically hard to start.

The patrolman also informed me that distributor points are a constant problem with cars he goes to. Undoubtedly the fact that points are a frequent cause of trouble is the reason why Chrysler has installed a new system in their latest cars which does not have distributor points.

It is little pleasure to a motorist to own a car which performs well when it is running, but is unreliable at starting in winter. Consequently he considers that all cars that are difficult to start should be equipped with CDI.

In other words I feel that the RAC has looked at only one facet of a car's performance in reaching the conclusion that CDI is not of "real benefit to the average motorist".

K.H., (Brighton South, SA).

CIRCUIT & DESIGN IDEAS

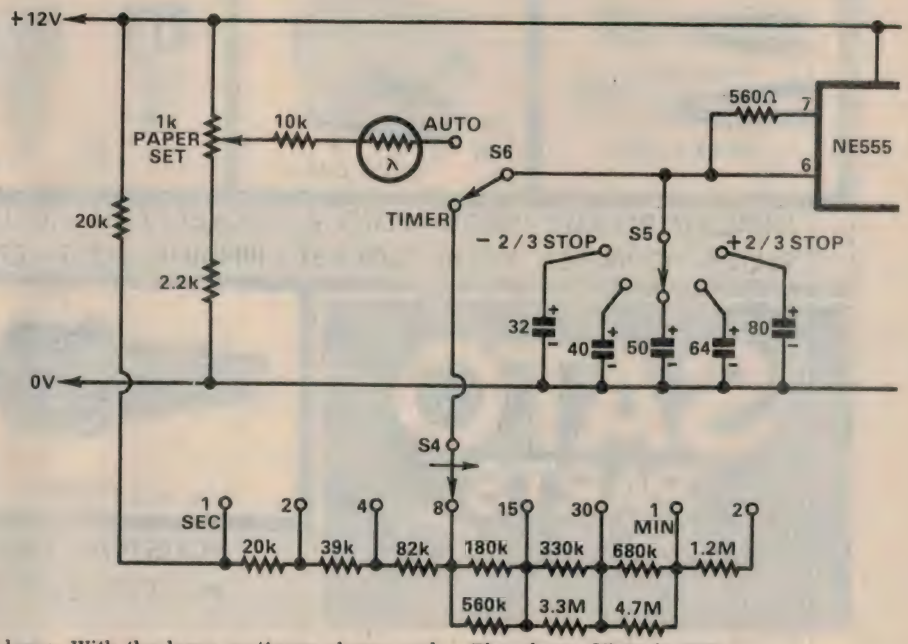
Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

Modifications to Photographic Timer

I have just built the Phototimer as described in May, 1973. I felt however, that the ½ stop separation was a shade too coarse and so I modified it as shown in the diagram. The main time selector switch (S4) operates in whole stops from 1 to 120 seconds, while the 50uF timing capacitor has been replaced by five capacitances and the switch (S5) which allows for times 1/3 or 2/3 of a stop over or under the nominal time selected by S4.

I have also added a circuit with a CdS cell, with resistors, potentiometer and switch, S6. This arrangement allows the timer to be used as an automatic printer in that when calibrated, the cell senses the amount of light reflected from the enlarging paper during exposure and adjusts the exposure time accordingly. The cell is shaded against stray light and is mounted in a set and accurately repeatable position, such that light from the entire surface of the print is reflected onto the cell. The 1k potentiometer is fitted with a large calibrated knob.

The cell is sensitive to the darkroom safelight and this may be solved by using a suitable filter — or the light may be switched off during exposure. I have arranged to take power for the safelight from across the triac in its non-conducting state. Connected in this way, the safelight is shorted by the triac as exposure is commenced and when the enlarger is switched off, power for the safelight flows through the enlarger



lamp. With the lamp wattages shown and with the timer off, the enlarger lamp will dissipate about 2 watts, which is not enough to make it glow. The safelight is not significantly dimmed by this arrangement.

(By Mr P. Sanders, 11/44 Strettle Street, Thornbury, Victoria 3071.)

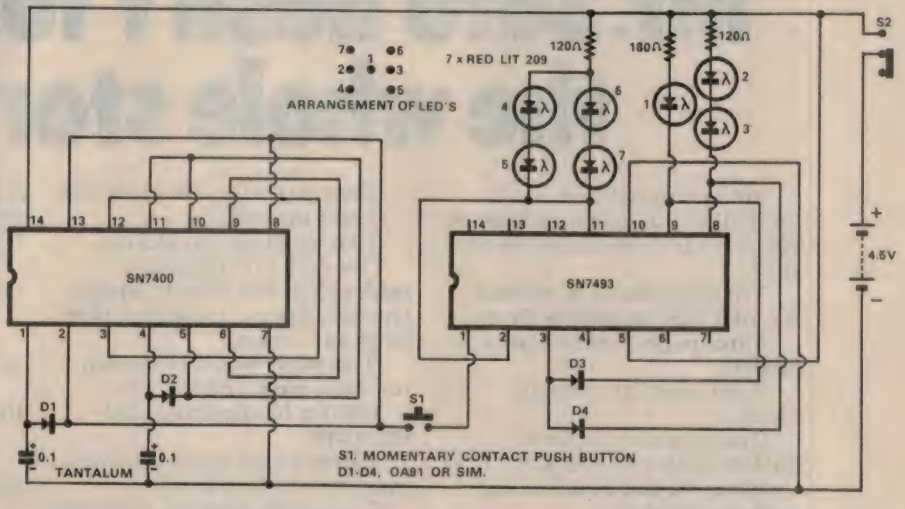
Editorial note: While we have some reservations relating to the suggested changes to the original Timer, we feel that a number of readers may be interested to try some of the ideas suggested.

Simple Electronic Dice

This electronic dice uses only two digital DIL ICs and seven LEDs in the readout. The prototype, complete with battery, fitted into a small plastic box not much bigger than a matchbox. It has one possible drawback in that it counts up to seven. This is not a real disadvantage, particularly when it is realised that getting the dice to throw a maximum of six would add complexity to a circuit where simplicity is a prime requirement.

The circuit is basically a three stage binary counter (using only three of the four stages of the SN7493) counting pulses from a high speed clock (SN7400). The player presses a push button which allows clock pulses through to the counter. The number displayed is dependent on the previous count and the length of time the push button is depressed. The random function is obtained by the fact that the counter operates so rapidly that the player cannot possibly predict the next count.

The LEDs are connected to the counter outputs. The diodes on the counter are used to extend an inbuilt two input clearing gate to a three input gate, which is used to prevent the counter from reading zero. Binary to decimal decoding for the readout is achieved by having a multiple of LEDs to



each successive binary column, as shown in the circuit.

In the prototype all the components including the LEDs were mounted on a single printed board, which was pushed close to the front of the clear plastic box so that the readout could be easily seen. However, the constructor may build it how he wishes, keeping in mind the arrangement of the LEDs, which are arranged so as to appear symmetrical like a normal dice for each count.

(By Mr S. Thomson, 46 Cornwall Road, Auburn, NSW 2144.)

Precision Tachometer Squelches Point Bounce

This tachometer circuit for automobiles with capacitive discharge ignition systems suppresses point bounce while measuring motor RPM accurately to within 1%. The circuit, which has an operating temperature range of -29 C to 65 C, can also be used as a temperature-compensated ratemeter or to eliminate relay-contact bounce.

Many automobile tachometers do not work properly with a capacitive-discharge ignition because this type of system employs the breaker points only for triggering an SCR. The voltage waveform across the breaker points, therefore, consists of a series of 14V pulses, rather than the 200V spikes that exist in the usual kettering ignition system.

The tachometer circuit shown comprises three sections.

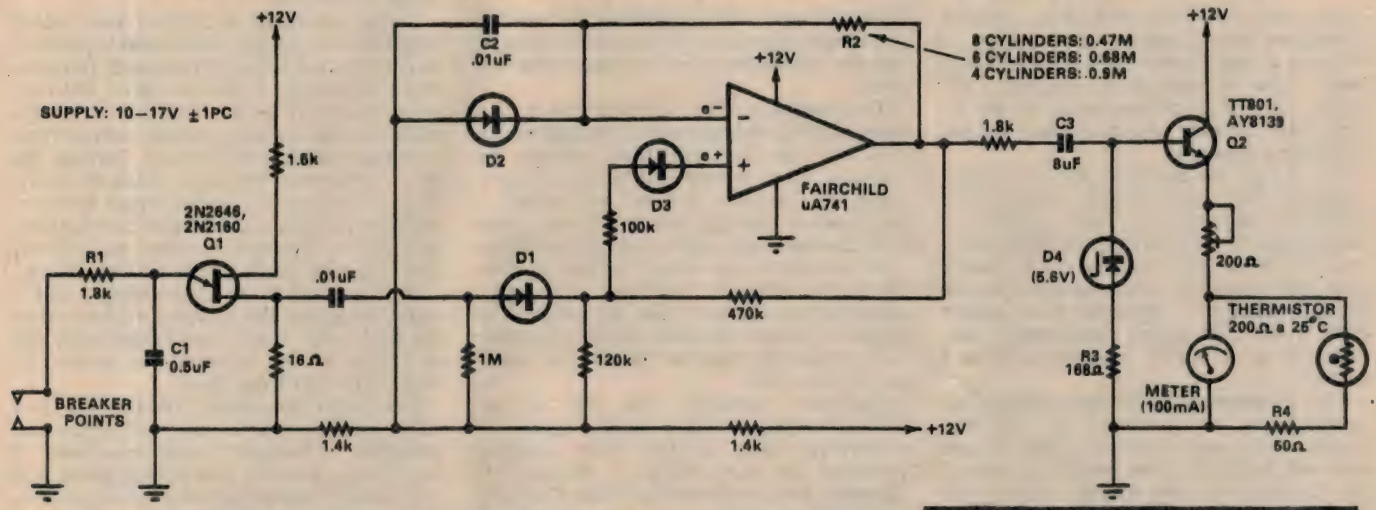
Unijunction transistor Q1 is operated with an emitter current that is larger than its valley current so that it will not turn off after triggering. When the points open, capacitor C1 charges through resistor R1 until Q1 fires (in 0.5 to 0.7 millisecond) and triggers the monostable. The current through R1 keeps Q1 on and prevents C1 from charging until the points close. If the points bounce upon closure, they will not be open long enough to allow C1 to charge and fire Q1 again.

For every point opening, the monostable produces a pulse having a fixed width and amplitude. Normally, the output stage of the operational amplifier produces a negative saturation voltage. But when a positive trigger from the relaxation oscillator is applied through D1, the op-amp's output switches to a positive saturation voltage, causing C2 to charge positively through R2. C2 stores the charge until e- is greater than e+, and the op-amp switches back to its stable state.

D2 clamps the voltage across C2 to about -0.6V, while D3 provides temperature compensation for changes in D2's junction voltage drop. Both of these diodes should be kept in thermal contact with each other. Since the op-amp is left floating so that it can be operated from a car's single supply voltage, it has a small positive output voltage when in its untriggered state, making C3 necessary to decouple the meter.

Zener diode D4 and R3 regulate the output against supply voltage variations, and the thermistor compensates for temperature variations in the base-emitter voltage of Q2. If a meter with a full-scale current rating of less than 5mA is used, the thermistor, as well as Q2 and R4, can be omitted.

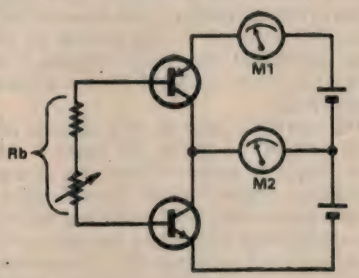
(By James B. Young, in "Electronics".)



DC Matching of Complementary Pairs

The emitter current at which matching is required is set up by adjusting Rb. Current meter M1 indicates this. Centre-zero meter M2 now displays the difference between the collector currents of the two transistors. The direction of deflection of M2 shows which transistor has the higher hFE. If the base-emitter drops can be allowed for, Rb may be calibrated in base current: this is useful information when the matched pair is transferred to a working circuit.

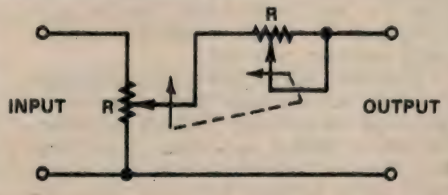
(By G. W. Short, in "Wireless World".)



Another Constant Impedance Potentiometer

This constant impedance potentiometer is similar to the one published in February 1973, but uses only two linear potentiometers, both of the same value. It is worth noting that there are certain restrictions on the applied source and load. If the input impedance is to remain constant then the load impedance has to approach infinity and if the output impedance is to remain constant, then the source has to be an ideal current source or the equivalent voltage source with series resistance approaching infinity.

(By Mr R. Harding, 5 Maroo Street, Doncaster, Victoria 3108.)



Beware the obvious symptoms

Most servicemen are proud of the practical skill they have built up over the years; of their ability to take in a set of symptoms and immediately nominate the offending component. But be on guard; symptoms can sometimes mislead.

On odd occasions sets may exhibit symptoms which appear, superficially, to indicate a well-known fault. In fact, they may be due to something completely different. If the fault happens to be intermittent as well, one can make an embarrassing mistake.

The story I am about to tell is a typical example. The fault, which I may have mentioned in previous notes, concerns a particular characteristic of the 6HG8 valve as a converter in TV tuners. As the valve ages, but before it reaches the end of its life in the normal way, it causes quite severe drift of the fine tuning adjustment, particularly on the higher channels such as 9 and 10.

This becomes progressively worse, first necessitating readjustment of the fine tuning control each time these channels are selected, then to the point where it is beyond the range of the fine tuning control, and finally to the point where it is beyond the adjustment of the oscillator slug.

Initially, this fault was, in itself, a hazard, since one could be tricked into making the necessary slug adjustment the first time the trouble occurred, only to be called back in a couple of months for the same fault. By this time it would be bad enough to necessitate replacing the valve.

Over the years, I have become so accustomed to this fault that, as soon as the symptoms appear, I simply replace the valve. Until now I have never known it to fail.

This particular set was about seven years old and I had already replaced the 6HG8 twice for this fault. On both occasions the cure had been immediate and permanent — or as permanent as it ever is.

Thus, when I was called to the set a third time for the same symptoms, after a period of over two years, I had no hesitation in nominating the same fault.

At this point it is worth digressing briefly to talk about the customer's approach to the problem. While it has no bearing on subsequent events, it was an interesting exercise in customer ingenuity, even if a somewhat risky one.

When the situation became so bad that the higher channels could not be tuned, the customer discovered that it was possible to receive his favourite channel by turning the turret slightly off its normal detent position. This is quite normal and is due to the slightly changed length of conductor as the biscuit contact is moved along the wiping contact.

Having discovered this, but not wishing to stand alongside the set holding the tuner in the offset position, he removed the back of the set and approached the tuner from the rear.

It so happens that this tuner has a convenient slot in the rear cover, through which can be seen the rear disc holding the biscuits. These are also slotted so it was a relatively simple matter to insert a screwdriver through the cover slot, then into the disc slot, and wedge the setup so that the turret was suitably offset and the particular channel received. Naturally, once this was done it was not possible to select any other channels, but the customer had apparently regarded this as the lesser of the two evils.

Ingenious perhaps, but not to be recommended for heavy handed types!

Anyway, back to the story. Having removed the screwdriver I checked all channels and confirmed the fault. The only point that struck me as unusual was the extent of the detuning. It had affected all three high channels (10, 9, and 7) so that channel 2 was now the only one still available. While noting that it was by far the worst case I had encountered, I thought little of it and any suspicions I might have had vanished when I plugged in a new valve and everything came good.

In this model set the tuner and other controls are mounted on a sub-panel which, in turn, is screwed to the inside of the cabinet alongside the main chassis, the tuner being in the top right corner as seen from the front.

The sub-panel is held by two screws, one top and bottom. To get at the tuner it was easiest simply to remove these two screws and withdraw the sub-panel. It was when I was replacing it that the trouble started. As I was attempting to replace the top screw (the set was still running) the screwdriver slipped and hit the shield around the 6HG8. Immediately the sound and picture vanished.

Thinking that I might have a faulty 6HG8 I fetched another from the truck and plugged it in. The set came good immediately, but I was more than a little suspicious of the whole situation by this time. I moved the new 6HG8 gently in its socket and the signals vanished. I moved it again and they returned.

I tried this a couple more times with much the same result, except that I found it was becoming increasingly difficult to restore the set to normal operation. Eventually, only the most careful positioning of the valve would produce a picture, while the slightest jolt would lose it.

It was now clear that the trouble was much more than a valve fault; it was in the tuner, and probably associated with the valve socket. It was hardly a job to tackle in the customer's home, but I decided to have a quick look for anything obvious.

So I pulled the cover off the tuner, removed a couple of the biscuits, and tried to get a look at the wiring. However, I could see only part of it, and nothing that was obviously wrong. There was nothing for it but to remove the tuner and take it back to the shop.

Back at the shop I removed the outer covers, then the complete rotor in order that I could get a good look at the wiring. There was nothing immediately obvious, so I connected it to another set and made a voltage check, moving the valve in the socket as I checked each point. This revealed nothing.

It then occurred to me that the trouble might be in the socket, the contacts possibly having become fouled or corroded. To check this I fished out a defunct valve and contrived to break away the glass envelope, while leaving the base and pins intact. Then I clipped away the elements, leaving the leads only above the base. Using the ohmmeter I measured the resistance between each pin and the associated socket contact, rocking the base in the socket as I did so. Once again I could detect nothing wrong.

That seemed to clear the socket, but I could not ignore the previous evidence that the fault was closely associated with the movement of the valve in the socket. So where did I go from here?

I decided to try a little brute force or, as a colleague is wont to say, "Abandon the scientific and resort to the primitive." I armed myself with a pair of long pliers — a pair with particularly good gripping teeth — and began a systematic "tug test" of all joints associated with the socket.

And that's how I found it. This model turret has a 5.6pF capacitor running from pin 7 of the socket (triode plate) to the chassis. The connection to the socket lug was perfect but when I tugged on the chassis pigtail it came straight out of the solder. Considering that this capacitor was directly associated with the oscillator circuit, it is easy to understand how the faulty connection to it had caused such a drastic change in behaviour.

To be fair, the soldered joint looked good. It was a nice smooth blob of solder on the chassis, with the solder seeming to flow nicely up the pigtail. Yet it was as dry a joint as any I have ever struck, the wire simply sitting in a hole in the solder.

Unfortunately, dry joints seem to be just as much a problem today as ever they were. They are insidious things, seldom apparent when the equipment is new or being tested, and often not showing up for several years. And when they do show up, they often cost a small fortune to find.

If it's any consolation, the entertainment side of the industry is not the only one plagued by them. As I mentioned on a previous occasion, my amateur friend tracked down several in a piece of communication equipment he purchased cheap after it had been discarded from commercial service. Nor was his experience an isolated one, his fellow amateurs regarding it as the usual thing. In fact, I suspect that a major reason for much of this equipment being replaced is that it is old enough for the dry joints to become troublesome.

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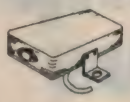

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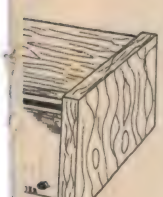

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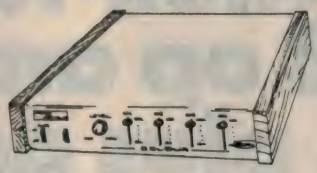

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Nor does the latest equipment appear to be much better. Another colleague is a full time maintenance technician for a company which runs a large fleet of radio equipped vehicles. Over the last couple of years he has been re-equipping the fleet with all-solid-state units in place of the old valve and hybrid units.

I asked him whether the solid state units were inherently more reliable than the valve units. "Oh yes," he replied, "with no valves to wear out or go noisy there is almost nothing to go wrong — once you've got rid of the dry joints, of course."

In short, the dry joint now appears to be at the top of the list in terms of inherent faults.

What is the answer? I wish I knew, I should make a fortune. Some claim that the power wrapped joint is the solution; others that dip soldering, as used on printed boards, is superior to hand soldering. Perhaps they are both right, yet I doubt if either is the complete answer.

Reverting to the tuner which started all this, I can only confess to having been completely fooled by the symptoms. With the benefit of hindsight I can appreciate that the extreme nature of the fault was significant, and I will watch for it in future. I will also give any replaced 6HG8s a good wobble in the socket before pronouncing the job finished.

Thus we learn by experience.

My next story concerns a very different type of equipment; a rather elaborate portable radio which the owner had purchased on an overseas trip. While I never did get the full story I strongly suspect that he had "been took", in that he believed the set was capable of both battery and mains operation. In fact, he subsequently realised that it was designed for battery operation only, although there was space for a power supply and for a switch to change from one to the other.

This had happened about two years previously, and when he made another trip overseas recently he took the opportunity to purchase a power supply. This was where I came into the picture.

While on a call to service his TV set he produced the receiver and power supply and wanted to know if I could fit the supply into the receiver and provide the necessary switch. He reminded me that I had done a similar job for his father a few years previously.

I recalled the job readily enough and that it had been quite straightforward. In the circumstances it seemed a reasonable request, so I agreed. Without taking too much notice of the individual units I simply bundled them into the truck — which was my first mistake.

When I eventually found time to study the situation in detail I realised that it was not going to be plain sailing. For one thing the owner had made the classic mistake of leaving the original batteries in the unit after they had been discharged and they had oozed chemical all over the battery compartment. As a result the battery contacts were badly corroded, though nothing else appeared to have been damaged.

More importantly, the power supply was of some make in no way related to the set and, while its electrical characteristics were quite suitable, it didn't even look like fitting in the space inside the cabinet.

What to do? After some pondering I rang the owner and explained the problem. Then I suggested that I extract the individual components from the power supply and mount them separately in the space provided, having already worked out a way in which this could be done with a minimum of trouble. There were, in fact only three components: transformer, full wave rectifier, and large filter capacitor.

He agreed readily enough, but I couldn't help thinking how much less complicated the whole exercise would have been if he had simply asked me to do the same thing, using locally available components, when he first realised that the set lacked a power supply. Still, that's the way it goes.

The job itself was relatively straightforward, the most fiddly part being to clean the battery contacts and battery compartment. Once this was done I soon had the power supply components in place and the set working from the mains.

Then I fitted a new set of batteries and flicked the changeover switch. Dead silence. Fearing a wiring mistake which might cause damage I switched off hurriedly and reached for the meter leads. A check across the battery showed a full nine volts, but this was obviously not reaching the circuit.

My first reaction was that I probably had not cleaned the contacts properly, but a closer examination seemed to rule this out. To make sure I shifted the negative probe up to the board where the battery wire joined it and the other one to where the positive lead joined the newly fitted changeover switch. When this read nine volts I moved over to the other side of the switch, suspecting a faulty switch. But no, the nine volts was still there.

I switched back to the power supply. There was a bit more than nine volts from this source, on no load, although it dropped to the correct value when I switched the set on. And the set worked.

I switched back to the battery and the set stopped. But now there was no voltage reading on the meter. I switched the set off and up came the voltage. It was as if the battery was seeing a dead short when it was switched into circuit, yet I couldn't imagine how this could happen without the power supply seeing the same short.

I switched the set on again and the voltage vanished. I moved the positive probe from the switch back to the battery terminal and it read nine volts. Well at least that was something; the fault was obviously between the battery terminal and the switch.

But you'd never guess where or why. The lead from the positive battery terminal was a solid wire insulated with plastic spaghetti. The goo from the run down battery had found its way along the wire, under the spag, and had steadily eaten it away.

Which would have been fine if it had completed the job, but it hadn't. What it had produced was a very effective high value resistor. Whether there was a vestige of copper wire left or whether the corrosion had some conductivity, I cannot say. All I know is that there was enough conductivity there to give a normal meter reading under no-load conditions. No doubt I helped by using a VTVM.

A simple fault, but one which caused me some head scratching and shook my faith in Ohm's law for a few minutes. Apart from the humour of the situation, in retrospect, the point of the story is that battery goo can find its way into the most unlikely places and cause some strange symptoms. So next time you clean up one of these spillages, make sure you clean it all up.

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LER 038

Television — Early Systems (2)

BBC low definition service. Early receiving equipment. Disc and mirror drum systems. Transmission scanning systems. Spotlight scanning. Intermediate film system. High definition systems. Zworykin's Iconoscope. Marconi-EMI and the Emitron. Baird's 240 line system. First high definition service.

By 1928, in spite of the limitations of the low definition system, Baird and his supporters felt that it should be given a trial as a public service, via the BBC. Initially, the BBC was less than enthusiastic, feeling that the quality was not good enough, particularly as such transmissions would have to be limited to the 9000Hz modulating frequency permitted for British broadcasting stations.

But the Baird camp persisted and, in March 1929, the BBC consented to an official test. The result was acceptance, in principle, of Baird's suggestion. After somewhat protracted negotiations, an agreement was reached whereby Baird was given five half-hour sessions a week for experimental transmissions.

These transmissions commenced on September 30, 1929. Initially, only one transmitter was available, so there was no accompanying sound. In March 1930 a second channel was provided, allowing simultaneous transmission of vision and sound. Vision was transmitted on 870kHz and sound on 1330kHz.

In 1932 Baird's apparatus and engineers were taken over by the BBC and his studios transferred to Broadcasting House. These transmissions continued until April 1934, when they were curtailed to two half-hour sessions a week.

The advent of these transmissions created a great deal of interest, particularly among experimenters. They found that, for the expenditure of a few pounds, they could convert the BBC signals into moving pictures.

Results could be obtained with equipment which was almost unbelievably simple. A neon tube, a disc (which could be homemade), and a small electric motor were the basic materials. The neon tube was connected in place of a conventional radio receiver's loudspeaker, the disc mounted on the motor shaft, the neon tube mounted behind the disc, and the experimenter was in business. A typical advertisement of the day offered a complete kit for £5-9-6 which could be assembled in 45 minutes!

The neon lamp was a special design using a relatively large rectangular plate as the main electrode. When viewed through the holes of the disc, running at the correct speed (750 rpm) and in proper phase, it created the image as its light output fluctuated in sympathy with the incoming signal.

Results from such simple equipment were strictly limited. In addition to the fundamental limitation of definition, the picture was small, about 45mm x 85mm, the light output quite low, and the light neon-pink rather than white.

There was also the problem of synchronisation. Initially this was left entirely to the viewer, who had to juggle the speed of his motor, using variable resistors and/or friction brakes, to bring his disc into step, in both speed and phase, with the scanning cycle from the transmitter.

Later, a serious attempt was made to transmit sychronising information along with the picture. This was done by simply masking the top and bottom of the picture slightly at the transmitting end. Vertical scanning was being used, so this produced a brief period of no signal between each line.

With 30 lines at 12.5 pictures per second, there were 375 lines transmitted every second with the same number of breaks between them. Thus, regardless of the picture content, and the other frequencies which it produced, because of the "black" pulses, the television signal always contained a prominent 375Hz signal. This became the synchronising signal.

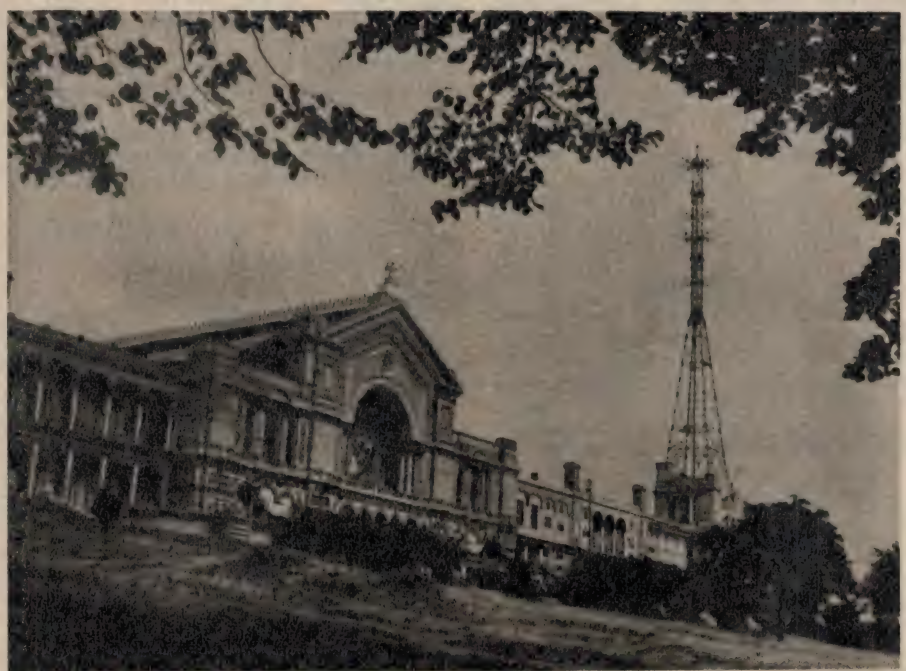
At the receiving end this signal was extracted and used to drive a small synchronous motor. This unit was additional to the main driving motor which was typically a series wound, brush type, "universal" motor, of about 1/30 horse power. The synchronous motor was mounted on the same shaft and was powerful enough to slow down or speed up the main motor once the latter was running at approximately the correct speed.

As well as holding the receiving disc in synchronous speed, the synchronous motor could be used to adjust the phase, or "frame" the picture. This was done by rotating the outer case of the motor, carrying the coils, thus causing the rotor to follow it.

The synchronous motor was connected in series with the neon lamp directly in the plate circuit of the output valve. The motor windings were bypassed with a capacitor to provide a path for the higher video frequencies.

Although the scheme worked reasonably well, it was not without its problems. Since there was nothing to differentiate between the black of the picture border, and a black which could occur within the picture, the system sometimes became confused. Large black areas at the top of, and running out of, the picture were particularly prone to cause loss of sync.

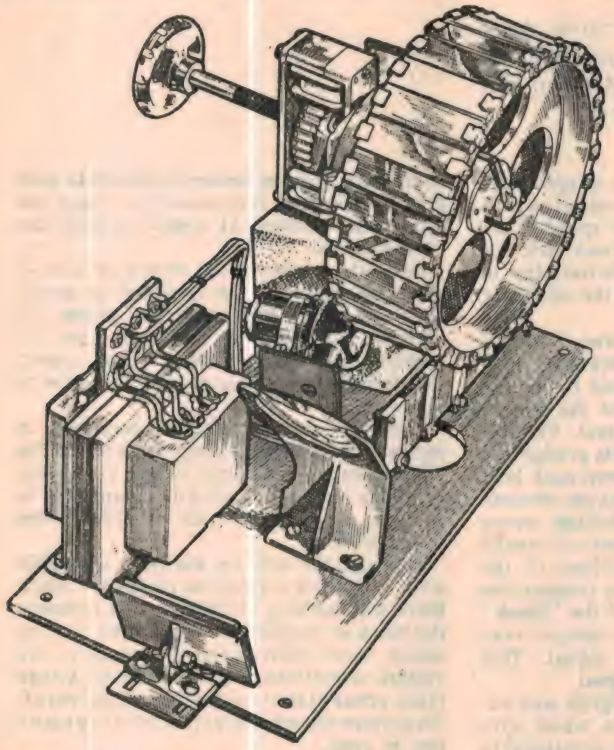
Many schemes were devised to produce a bigger and brighter picture. The basic approach was to use a relatively high powered lamp (100W projector type) in



Alexandra Palace, London, where Britain's — and the world's — first regular high definition TV system was established. Two sets of vertical aerial elements are supported between the four sets of radial arms, the top set for vision, the bottom set for sound.

place of the neon lamp. Since filament lamps cannot be modulated at the frequencies involved, a variety of light valves was devised.

One of the most popular used a pair of Nicol prisms and a Kerr cell. One prism polarised the light beam which would then pass through the second prism only if its polarisation was undisturbed. The Kerr cell uses an electrostatic field to rotate the polarisation, thereby effectively modulating it.



The Baird 30 line mirror drum scanner. Each of the mirrors on the drum is set at a slightly different angle. The Kerr cell is to the left and below the drum. The light beam from it strikes the mirror in the foreground and is reflected onto the drum via a lens. Note the synchronising motor on the rear of the drum, with a phasing control knob protruding from it.

Such a cell was commonly used in conjunction with a mirror drum scanner. The mirror drum system, though more complex, was more compact. A typical drum would measure about 150mm in diameter and 40mm wide. Around the outside of the drum was fastened a total of 30 mirrors, one for each line. The modulated light beam from the lignt valve was focussed onto these mirrors.

The drum was mounted on its vertical axis so that, as it rotated, the beam was swept vertically from the top to the bottom of the screen. To provide the vertical scan, each mirror was set at a slightly different angle, so that each line was traced alongside the preceding one.

The beam from the drum was normally directed onto a ground glass screen, which was viewed from the opposite side. The result was a much larger, brighter picture composed of white light. Kits for this type of receiver were also marketed, particularly by Baird (Baird Television Ltd) and sold for about £25.

Transmitting equipment was somewhat similar. For studio work a mirror drum scanner converted the light from an arc lamp into a series of lines which scanned the scene, while the reflected light was collected by banks of photocells. For films a simple disc scanner was used.

The most difficult image to handle was the outdoor scene. Such a scene could not be scanned with a beam of light, and attempts to direct the image onto photocells after dissection had not been very successful, due to the enormous light loss involved.

This led to the intermediate film system. The scene was photographed with an ordinary movie camera, typically mounted on top of a van for sporting events. A light tight tube ran from the bottom of the camera into the van which was, in effect, a film processing plant.

There was no takeup spool on the camera, the film running straight from the gate into the tube and thence to the processing tanks. High speed developer and fixer were used and the processed film, still wet, was taken straight to the scanning gate, which was under water. The film was then run into a tank of water until such time as it could be dried and spooled.

Typical delay time between camera gate and scanning gate was 30 seconds, although the German Fernseh A.G. company managed to reduce this to 10 seconds.

A variation on this idea, which was tried with limited success, was to pass the film through a stripping bath after scanning, remove the emulsion, then pass it through an emulsion coating bath, dry it, and pass it back to the camera. Thus only a relatively small loop of film was required.

Regardless of the particular system, the sound was recorded on the film at the same time, to delay it by an equal amount. It was generally claimed at the time that the small delay was of little consequence if an image of an important event could be transmitted.

A similar system was used to present large screen television pictures in a theatre. The television image was recorded on film, the film processed at high speed, and passed straight into a conventional projector.

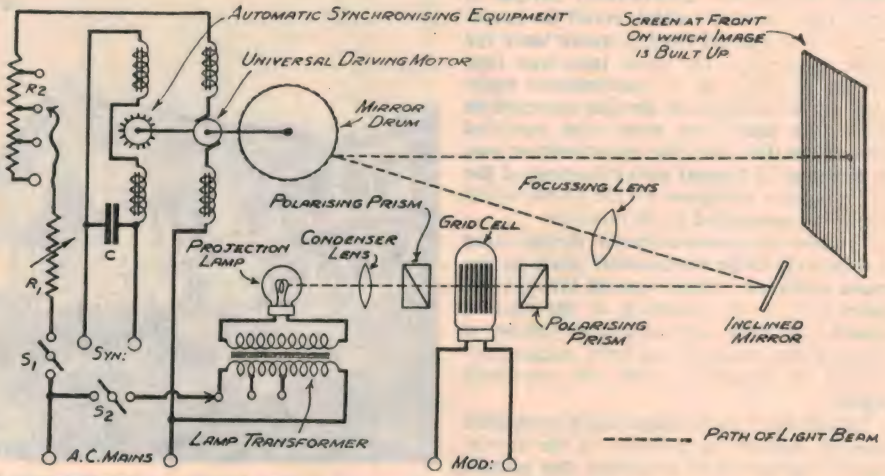
There were many minor variations of these basic television systems suggested and tried between 1929 and 1934 and it is impossible to detail them all. What we have described should give a fair idea of the state of the art at that time.

In fact, time was running out for all such low definition systems. The truth was that, in terms of television research, they were only the tip of an iceberg. Because they had the advantage of technical simplicity and low cost, and had "arrived", the low definition systems had generated an enthusiastic following and created plenty of publicity.

But results were too poor to be taken seriously. Only the most ardent enthusiast could derive any real entertainment from such a system, once the novelty had worn off.

Several groups of workers, in both Britain and the USA, had long appreciated this, and had set their sights on a much higher standard; the so-called "high definition" system. So, while the low definition systems temporarily captured the public imagination, the high definition enthusiasts were working hard, with little publicity, toward a goal which they believed would be really worthwhile, even if it took longer to develop and cost more to implement.

The high definition system was an ambitious concept, with many problems to be overcome. Probably the most basic was to find a substitute for mechanical scanning, since the size and complexity of the latter grew enormously as the number of lines was increased. This, combined with their unsuitablity for outside broadcasts, ruled



A theoretical diagram of the drum scanner, best studied in conjunction with the other diagram on this page. Note the light path from the lamp, through a polarising prism, the grid (Kerr) cell, a second polarising prism, thence to the drum and the screen.

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them out. Campbell-Swinton's original suggestion based on the cathode ray tube was the logical alternative, but converting this general concept into practical hardware was a formidable undertaking, even allowing for the enormous technological advances which had occurred in the intervening years.

Then there was the equally basic problem of the bandwidth required. The low definition experiments had used the broadcast or short wave bands and had not generated modulating frequencies much above 10kHz; 15kHz at the most in one or two special cases.

Because an increase in the number of lines requires that the definition within each line be upgraded proportionately, bandwidth increases roughly as the square of the increase in line numbers.

Thus, while the highest possible number of lines was desirable, this requirement had to be balanced against the bandwidth problem. To make matters worse, no one was quite sure just how many lines would be needed for an acceptable picture. Suggestions ranged from 60 lines to 120, 180 and 240.

There was also the problem of handling the vision (video) frequencies before modulation and after detection. Even 10kHz for a low definition image presented problems. When someone suggested a 100 line system at 25 pictures a second it was calculated that the video frequencies would be in excess of 300kHz; a formidable figure at that time.

The suggested solution to the spectrum space problem was to use the ultra short-wave (VHF) bands. There was plenty of room there, the main problem being that they were not well understood at that time. Even while advocating their use, engineers realised that a lot would have to be learnt before it was practical. Much the same applied to the video frequency problem, though they were more confident of coping with this.

Nevertheless, a lot of real progress had been made, particularly in the USA by Zworykin of RCA. The general TV scene in the USA had run roughly parallel to that in Britain, with Jenkins, and others, experimenting with a multiplicity of mechanical systems. But as early as 1923 — only one year after Baird commenced his experiments — Zworykin had begun work on an all electronic system. By 1929 he was able to stage a demonstration which proved that such a system was possible, even though it was still very much in the laboratory stage.

In Britain the high definition champions were Electrical Musical Industries Ltd (EMI) and the Marconi Company. In the 1920s the Marconi Company had carried out extensive work on the development of a high speed facsimile system. In so doing they had encountered, and solved, many of the problems inherent in the transmission of high definition television signals.

EMI had also been conducting television experiments. Like everyone else, they faced the vexed question of "how many lines?" and, in 1931, developed an experimental 120 line film scanner. To test it, and the 120 line concept, under working conditions, they needed a VHF transmitter. They ordered it from the Marconi Company.

Thus began a close liaison between these two companies; one which was to have a marked effect on subsequent events.

Zworykin's work, particularly that associated with an electronic camera tube, and his demonstration in 1929, had aroused a good deal of interest in the EMI team. They even considered buying the knowledge which RCA had already acquired. As it turned out, the price was too high, and they decided to "go it alone".

In the team which shouldered this task were a number of engineers worthy of special mention: J. D. McGee, A. D. Blumlein, C. O. Browne, N. E. Davis, E. Green, and a number of co-workers. Blumlein is generally regarded as one of the most brilliant engineers of his time. Tragically, Blumlein and Browne, another brilliant worker, were killed in a plane crash while engaged in advanced radar research during the war.

The team's major effort, involving mainly McGee and Blumlein, was undoubtedly the production of a camera tube, similar to that being developed by Zworykin, which they called the Emitron. The patent for this was issued in 1932. (Zworykin published a description of his tube, which he called the Iconoscope, in 1933.)

While McGee appears to have been largely responsible for the Emitron itself, Blumlein concentrated on devising circuits which would compensate for the many deficiencies of this type of tube (which it shared with the Iconoscope). Later, Blumlein was also responsible for developing the television waveform on which the complete EMI television system was based. A patent for a much improved version of the Emitron was issued to McGee and Blumlein in August 1934.

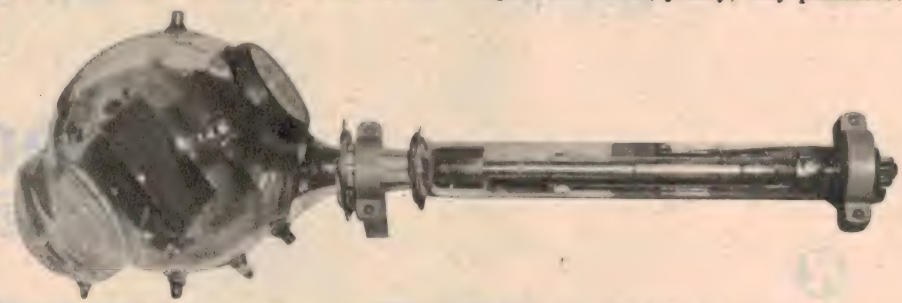
Other members of the team concentrated on the standards to be adopted, and the hardware to achieve it all. The number of lines was a particularly contentious issue. In finally opting for 405, the team seemed to be flying in the face of commonsense. There were many prophets of doom who maintained that the bandwidth required could never be handled; that 180 or, at most, 240 lines was not only adequate, but all that could be achieved in practice.

Dr V. K. Sworykin shown holding the Iconoscope which he developed. Note the similarity to the Emitron. Both were developed independently in the same general period, although Sworykin started his development much earlier.

In spite of the sceptics, by 1934 the team felt that they had a viable system; a system which they could offer to the authorities with the assurance that it would achieve lasting public acceptance. As it turned out, the year 1934 was a significant one in television history; one in which many far reaching decisions were made.

Early in 1934, Baird demonstrated a 180 line system on VHF. The vision signals were transmitted on 50MHz and the sound on 48MHz. Mechanical scanning was used at the transmitter but the picture was displayed on a 12in diameter cathode ray tube.

Around the time Baird was demonstrating his 180 line system, EMI and the Marconi Company were making the logical move in view of their common interest in television, and the broad background of experience which, jointly, they possessed.



An original Emitron, as used for the world's first regular television service, inaugurated by the BBC! The spherical portion contains a rectangular mosaic plate onto which the image is focused through the optical glass window on the right.

a turntable with a heart

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They joined forces to form the Marconi-EMI Television Co Ltd.

About March 1934 the BBC decided to reduce the 30 line transmission to two half hour sessions a week.

In May 1934 the British House of Commons appointed a Television Committee, "To consider the development of television, and advise on . . . the relative merits of the several systems . . ." Blumlein, among others, gave evidence before the committee to the effect that Marconi-EMI could provide a 405 line all-electronic system. Baird Television Pty Ltd also gave evidence, proposing a 240 line system.

In January 1935 the report was presented to the Postmaster General. Among other things it recommended a high definition system of ". . . not less than 240 lines with a minimum picture frequency of 25 per second."

In August 1935 the BBC announced acceptance of the recommendation. Both systems were to be given a trial, operating on alternate weeks. Baird was to use 240 lines, 25 pictures per second; non-interlaced, with mechanical scanning. Marconi-EMI was to use 405 lines, 25 pictures per second interlaced, and all electronic scanning.

Each system was to have its own studio equipment and vision transmitter. A third transmitter, common to both, was provided for the sound. Vision was to be radiated on 45MHz and sound on 41.5MHz.

As a result of this announcement the pressure was really on for both organisations. Baird, still backing mechanical scanning, had to produce a 240 line system capable of handling large studio scenes, film scanning, and outdoor subjects. The fact that he did produce such a system is a tribute to his ability and determination.

EMI faced a similar situation. In early 1935 they had only a few prototype units in existence, from which they had to produce a complete working system ready to go to air. The fact that they did this in 18 months is a tribute to not only their technical ability, but to their unbounded enthusiasm and willingness to work as a team.

The BBC was also under pressure. Alexandra Palace had been chosen as the site for both studios and transmitters, mainly because it was already 100 metres above sea level, and height was important for good VHF coverage. A major job was to strengthen one of the building's corner towers and then to erect a steel tower, another 100 metres high, above it.

Internally the building had to be converted into studios, dressing rooms, administrative offices, transmitter rooms etc. Then the two companies had to supply, install and test their equipment.

By late 1936 both systems were installed and working and both went on the air for experimental periods. The system was formally opened on 2 November 1936. There were in fact, two formal opening ceremonies, one transmitted on each system. After that the two systems operated week about for the trial period.

(The receivers of the day had to be fitted with a time base changeover switch in order to accommodate the two different line frequencies; 6000Hz for the Baird system, 10,125Hz for the EMI system.)

Both systems provided similar facilities, though by quite different methods. Both could televise live studio productions, sound films, and outdoor scenes. In regard to the latter, both suffered a common limitation; the distance between the camera and transmitter.

Initially, the maximum length of cable between the camera and the transmitter had to be limited to about 330 metres. This meant that outdoor scenes were limited to those that could be staged in the grounds of Alexandra Palace. These were devoted largely to demonstrations of various sporting techniques, golf, tennis, riding etc, by well known experts in these fields.

Apart from this problem, which was soon overcome, the Marconi-EMI system faced no serious limitations. The Emitron camera was just as much at home out of doors as it was in a moderately well lit studio.

Two film scanners were provided so that, as in normal theatre practice, a continuous program could be presented from standard reels of film. The scanners were standard intermittent film projectors, slightly modified, and arranged to run synchronously with the waveform generators. They simply projected the film image onto the mosaic of the Emitron.

The Baird system was not nearly so versatile and, while they could perform all these functions, many of them had to be done the hard way. For small scenes, such as three-quarter length presentations, or interviews involving two people, the "flying spot" system was used.

This was similar to that used for the old 30 line system, but upgraded to 240 lines. The light source was a powerful arc lamp, and scanning was by means of a disc punched with 240 holes in a spiral pattern, running at 1500rpm in a vacuum.

For larger scenes, it was difficult to obtain good light coverage using this method, and it was necessary to employ the intermediate film system, which has already been described. This system was also used for outdoor scenes.

For film scanning, involving either rapidly processed intermediate films or standard commercial films, a disc scanner was used, but with a novel modification. Rather than a spiral, the holes were arranged in a circular pattern, providing horizontal scanning only. The vertical scanning was provided by the film, which was moved through the gate continuously, rather that intermittently as for normal projection. This system of continuous motion is still used today, in conjunction with the cathode ray type flying spot scanners.

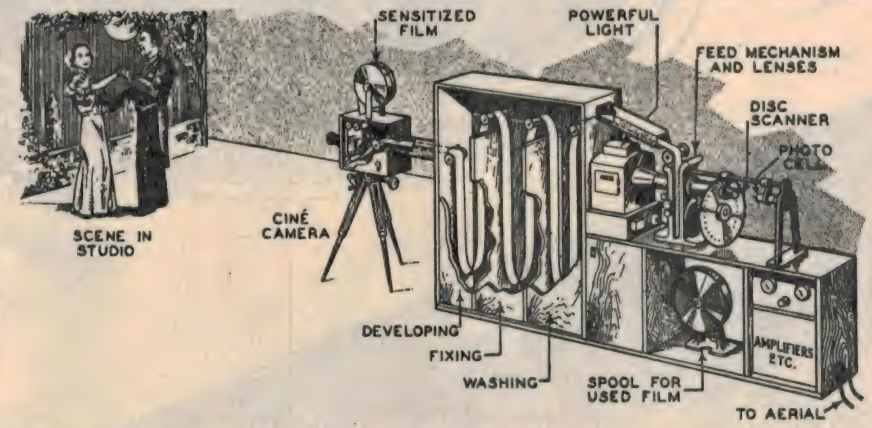
By February 1937 the BBC had made its decision; it favoured the Marconi-EMI system. On 5 February 1937 the Baird system was dropped and the world's first regular public TV service settled down to the more or less routine job of supplying programs and learning what could be done.

Even at this early stage the system had so proved itself that Blumlein, representing Marconi-EMI, went to the USA to negotiate a free exchange of "know how" with RCA. By this time RCA were only too happy to agree.

The next big step was to shake off the shackles imposed by the limited length of cable between camera and transmitter. In this case there was a particular incentive; the coronation of King George VI was set down for May 12, a mere three months away. Everyone was anxious that this should be the first outside broadcast.

To do this it was necessary to develop a complete mobile TV station; cameras, control room, VHF transmitter, power plant etc, to relay the signals to the Alexandra Palace transmitter.

The system was developed and built by Marconi-EMI and delivered to the BBC just in time for the coronation. It was built into three large vans. One van carried the camera control equipment capable of handling three Emitron cameras, plus the sound circuit, control, and microphones.



A studio type intermediate film system similar to that used by Baird for his high definition system supplied to the BBC. Although some systems scanned the film under water, this one appears to dry it first, apparently using the heat from the lamphouse.

The second van carried the modulation amplifiers, a 1kW VHF radio transmitter (85MHz), and a demountable directional aerial. The third van carried generating plant for use where AC mains were not readily accessible.

As well as providing a radio link, the system could work into a cable link where one was available. A suitable cable had been provided between Alexandra Palace and Broadcasting House, and to a number of points in the West End of London.

Although the equipment was delivered to the BBC only days before the coronation, with little time for testing, they decided to attempt televising the coronation procession. In spite of these hazards, and poor light caused by overcast weather, the experiment was a complete success. As a precaution both the cable link and the radio link were used, one to serve as a backup if the other failed.

From this point on development was more of an evolutionary nature, but much progress was made before the outbreak of World War II in 1939 closed the system for the duration.

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Elementary Electronics

by Ross Tester

Recently, I visited a relative in one of Sydney's more affluent suburbs. Shortly after I arrived, other friends arrived and parked their car behind mine in the street outside.

Later in the evening, it came time to leave, and I went outside to my car. It was there — my friend's was not. It had joined the growing number of cars stolen each day.

I do not want mine to become one of these. Therefore, there is an ulterior motive behind Elementary Electronics this month — as well as providing us with a project and story, it provides me with a car burglar alarm!

In considering a burglar alarm, we first had to decide which type. There are a number — ranging from very cheap to very very expensive. An example of the first would be a spring-loaded switch connected to the car door, with an outside switch to turn the device off for legitimate entry.

Another idea is to use a mercury switch; a glass tube with a pair of contacts at one end and a ball of mercury rolling round inside it. Any movement which allows the mercury to flow to the end of the tube containing the contacts closes the switch. One of these could be added to our burglar alarm if desired.

Among the more expensive types is one which works on a doppler principle. If anything moves inside the car, an alarm goes off. Such alarms are available but, at around $250, they are a little outside my price range!

In between these extremes is a time-delay type. This involves no outside switch, but a time delay enabling you to get into the car and quickly turn off the (secret) alarm switch before the timer allows the alarm itself to function.

This is the type we shall be considering. It involves very little connection to the car's electrical system — a major worry in some cases. Primarily, it works from the switches for the interior dome light (courtesy light), but other switches may be added wherever illegitimate entry could occur: bonnet, boot, etc; or where special protection might be required: glovebox, etc.

Other forms of protection (as well as the alarm) are possible. For example, a pair of contacts on the relay could be used to disable the ignition system. This idea does have disadvantages, as we will discuss shortly.

In designing a burglar alarm for Elementary Electronics, we naturally had to keep in mind the cost (and complexity) of the project. We evolved what we consider to be a reasonable compromise. The complexity and cost have been kept well down, but the device is a completely practical one, which should give a good account of itself in any car.

There are two schools of thought regarding the alarm itself, which is usually (for convenience) the car horn. One idea is to have the horn operate continuously after an attempt has been made to break in, even though this will almost certainly flatten the battery in a few hours. The idea behind this is that a car with a flat battery is better than no car at all.

The other idea is to have a time-out circuit which automatically stops the car horn after a set period — say five minutes or so — and re-sets the alarm for another possible attempt by the intruder.

Both ideas have merit. The first is simple, and costs are kept to a minimum. The second has obvious advantages from the point of view of the car owner. Our alarm is designed around the latter approach.

The complete alarm has three time delay circuits; one for the above function, one to permit exit from the car after the alarm is turned on, and one to permit entry before it is turned off. While many of the components needed in the alarm may be obtained from the "junk box," where time delays are concerned it would be better to use all new components in the interests of reliability.

Reliability is all-important in a burglar alarm. It is inconvenient, for example, to have the alarm tripping every time it gets warm. Many automotive alarms have a tendency to do this. To check ours out on this score, we operated it for approximately half an hour in artificially elevated temperatures similar to those found in a car on a hot summer day (60C). It worked perfectly.

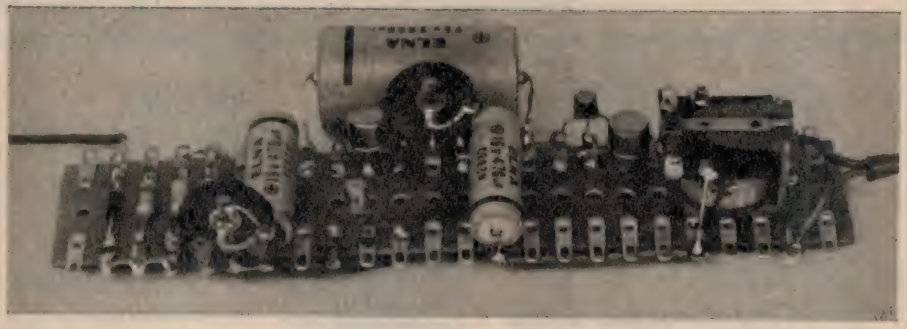
While we built our alarm on a piece of resistor tagboard, there is nothing to stop those inclined using a piece of Matrix or Veroboard. Those with the ability could even design a printed board. Any of these arrangements would probably save space.

The finished device needs some type of covering. Otherwise, dust may cause problems with the operation of both the relay and the trimpots. It may be a little difficult to obtain a box of the required shape — the tagboard is quite long.

The reader may be able to fabricate his own from, say, tinplate, thin aluminium or plastic; alternatively, he may care to cut the board into approximately equal halves and accommodate them one above the other with the necessary interconnections.

One of the smaller aluminium "minibboxes" could then house the alarm comfortably. Whatever the arrangement, it would be wise to drill holes in the case to allow screwdriver access to the trimpots, in case you wish to adjust the times.

Circuit operation is relatively straightforward. As the driver leaves the car, he closes the main switch last thing before he closes the door. As the main switch closes, C1 begins to charge via trimpot R1. After a predetermined time (selected by setting R1) the voltage across C1 reaches the zener voltage, the zener conducts, and TR1 is forward biased. The time taken for C1 to charge is the "exit time" and may be set to, typically, about 30 seconds.



The complete alarm circuitry built on a length of terminal board. The pot on the left controls the exit time and the one in the centre the entry time. A more compact assembly could employ two shorter boards stacked one above the other.

Although TR1 is forward biased at this stage it does not conduct because TR2 is not forward biased. The circuit remains in this state until one of the sensing switches (door, boot, etc) is actuated. As soon as this happens TR2 becomes forward biased and both it and TR1 conduct. At the same time C2 charges very quickly via R2. It is held charged, and TR2 is held on, while ever the door switch is closed.

Because TR1 and TR2 are turned on, C3 charges via R3. Once C3 reaches the zener voltage, the BC108 / TT801A Darlington pair

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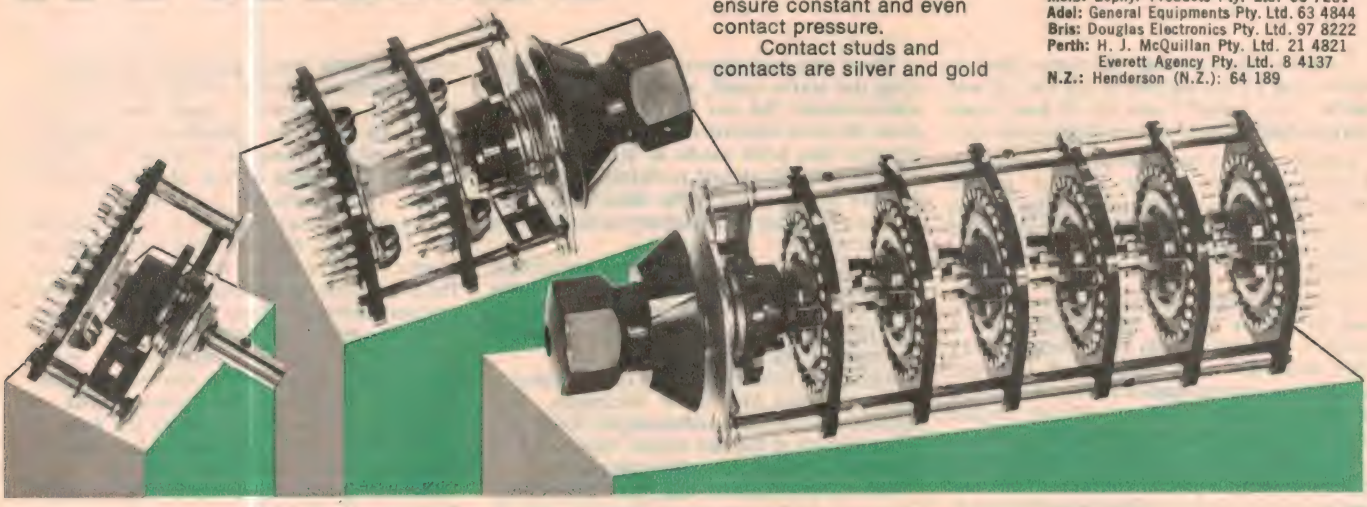

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turns on, pulling in the relay. This relay is connected in turn to the horn relay, which operates the horn. The time C3 takes to charge is the "entry time" which may be set to, typically, about five seconds.

The legitimate user of the car will normally open the main switch (which should be concealed) within this period, and the alarm will not sound. In the event of an unauthorised entry this switch would not be operated, and the sequence would follow through as described, sounding the alarm about five seconds after the door was opened.

This chain of events will occur regardless of how quickly the door is closed after it has been opened. Suppose the thief opens the door, slips quickly inside and slams the door after him, all in less than the suggested five seconds entry time.

This is where C2 comes into the picture. Remember we explained that it would charge very rapidly when a door contact was closed. In fact it will charge in about half a second and, once charged, provides a latching function by continuing to supply forward bias for TR2 after the door switch is opened. Thus, the smart thief will achieve nothing; the alarm will still operate after the five second entry time.

This latching circuit has another function; it determines the length of time the horn will remain on after the circuit is tripped. Capacitor C2 discharges through two paths — the 56k resistor and the 1M resistor, and the 56k resistor and the base of TR2. Because the resistance of the first path is so high most of the current flows through TR2. This constitutes forward bias for TR2.

Therefore, the alarm will continue to sound until the discharge current of C2 is so small that it cannot hold TR2 on. When this happens, the relay drops out, but the circuit immediately re-arms itself in case the intruder decides to have another go.

With the component values shown, the alarm should remain on for at least five minutes, possibly longer. It would be possible to double this time by connecting another 2200uF capacitor in parallel with C3.

To make the alarm circuitry suitable for positive chassis vehicles, simply replace the BC108s with 2N3638As, the 2N3638A with a BC108, and the TT801 with a TT800. Reverse all zener diodes and polarised electrolytic capacitors, and mark the active rail "negative" and the chassis rail "positive."

We mentioned before that a multiple contact relay could be used to both sound the alarm and disable the ignition system (many commercial alarms use this system). In this condition, the car would be impossible to start. While this is fine in theory, there are problems.

The first is that there is now one more thing which might go wrong in the ignition system. While this is not very likely, it must be considered. Much depends on the method of disabling.

If the relay contacts are used to open circuit the primary of the coil, there is a real reliability problem. The smallest amount of dust between the contacts might render your car inoperative.

An alternative approach is to use the contacts to short-circuit the ignition points. This has the advantage that, in normal use, the contacts will not form part of the ignition system, or be required to carry current. The risk of ignition system failure in these circumstances is extremely remote.

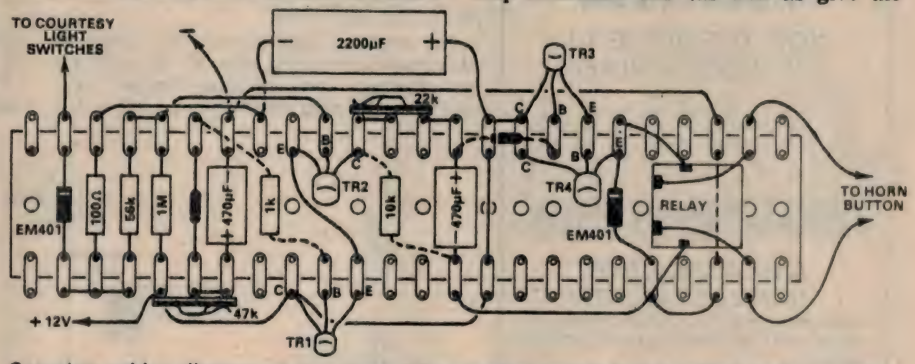
However, if a thief has gained access to the car without tripping the alarm, and bypasses the ignition switch, a heavy current will flow through the coil. If allowed to continue for any length of time, the coil will overheat and, eventually, may burn out.

There is also the risk that the smart thief will spot the leads to the points or coil, and if he knows anything about cars, will realise that they are foreign to the system.

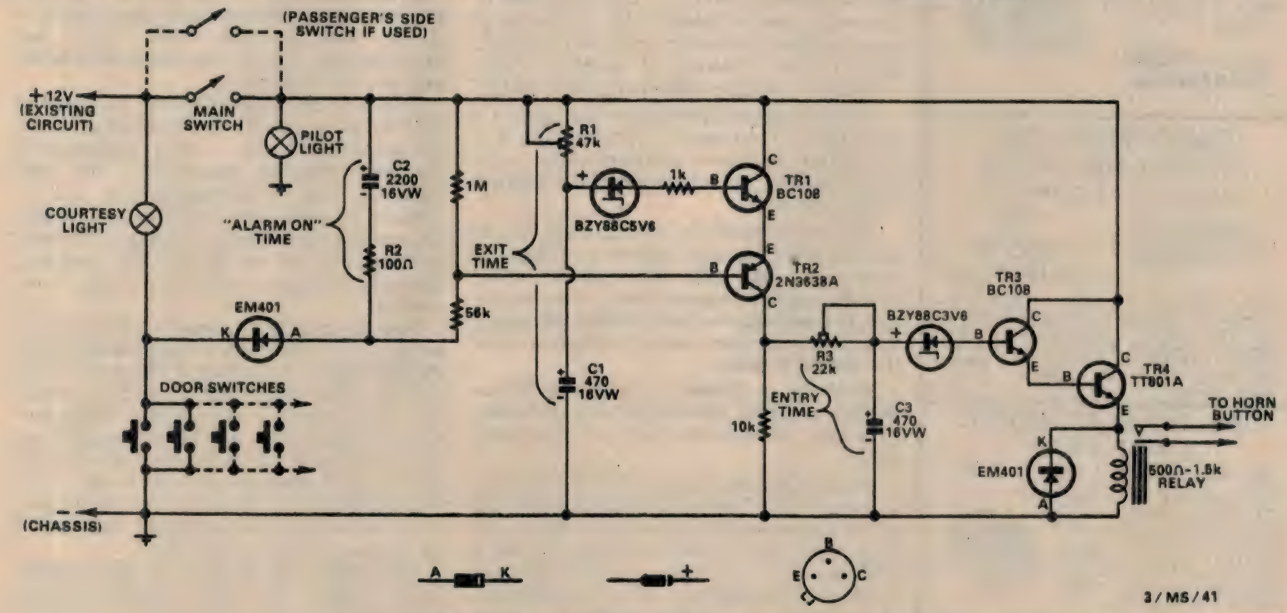
Fitting the alarm is the next step. First of all, you must determine whether or not your car has a horn relay. A shop manual may help determine this (as well as give the colour coding of the wires) but, in its absence, follow the circuit back from the horn itself to see whether it goes directly to the steering column, or via a small metal or plastic box.

If there is a horn relay, you are in business. If not, one will have to be fitted, as the small contacts on the alarm relay will not stand the heavy current (10A or more) drawn by the car horn.

The diagrams on the next page will help. Note that a negative chassis car is shown. A positive chassis car will have different wiring — but as these are now becoming rarer, we will leave wiring of these to the reader. Most modern cars will be negative chassis types.



Complete wiring diagram of the alarm. The physical layout is not critical and any other convenient arrangement should be satisfactory. As an aid to wiring compare this drawing with the circuit below and the photograph on the first page.



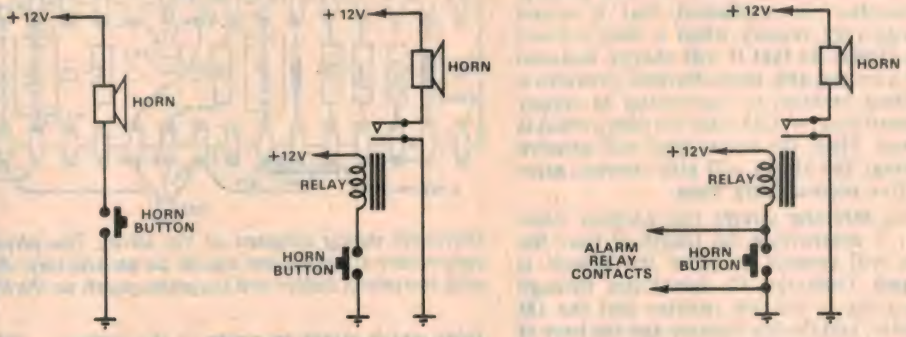
The circuit employs three time delay networks; exit time, entry time, and "alarm on" time. Each of these is marked and, in conjunction with the text, should make it easy to follow the operation. The "alarm on" time may be increased by increasing C2.

A horn relay diverts the heavy current of the horn away from the horn button and through its own contacts, which are designed to withstand the load.

The relay coil is connected between active (positive) and the horn button. The other side of the horn button is connected to chassis (negative). When the horn button is pressed, the circuit is completed, and the relay energises — thus closing the contacts and sounding the horn. Horn relays are available from motor accessory houses for a couple of dollars, if they are not already fitted.

The author obtained one from a disposals source for fifty cents!

The courtesy light circuit must then be identified and tapped into. In the author's car, this was easy, because "bullet" connectors were used and I simply pushed the end of the wire from the alarm into the connector along with the bullet. Other cars may not be so easy — you may have to cut the lead and re-solder it, covering with insulation tape, or fit a bullet connector.



(a) BASIC HORN CIRCUIT (b) BASIC HORN RELAY CIRCUIT (c) HORN RELAY CIRCUIT WITH CONNECTIONS FOR ALARM RELAY

Your horn circuit will be either as (a) or (b). If as in (a) a horn relay should be added and the alarm relay contacts wired in parallel with the horn button.

It is possible to use a boot light switch as a burglar alarm switch (in case the boot is forced open). Most boot light switches will be wired in the same way as the courtesy light switches; positive to lamp, then to switch and chassis. If so, the lamp side of the switch can be linked to the lamp side of the courtesy light switch, and both will then perform the function of burglar alarm switches as well as their original function.

If the car has no boot light switch, now is a good time to put one in! A boot light is a very handy accessory on a dark night — and once installed, you will wonder how you got along without it.

Remember that the wiring must be as shown for the courtesy light in our diagram. Some light kits may show other wiring (the kit will have instructions). If the wiring differs from what we have shown, disregard it, as it must be done the way shown to allow the alarm to work.

Similarly, a bonnet switch may be installed to detect the bonnet being forced. This may or may not have an associated light.

One problem may occur with the horn. On a few cars, the horn is disabled when the key is turned off and removed. If this is the case, it will be necessary to either install a different type of alarm, or by-pass the key by placing the horn wire, via a suitable fuse, to a point on the fuseboard where power is applied at all times. A multimeter will soon reveal where these points are.

Incidentally, when locating a take-off point for power to the burglar alarm, make sure that it, too, has power applied at all times.

We have shown a pilot light connected after the burglar alarm switch. The reason for this is not so much to tell you that it is on, but to act as a deterrent to possible intruders.

A commercially available alarm also uses this system, so we are, in a way, "cashing in" on their publicity. A thief will be unlikely to try to enter a car which he knows is equipped with an alarm — he is most likely to try the next one down the street.

Another idea is to use a label on each of the windows advertising the fact that there is a burglar alarm in the car.

The main switch must be mounted in an easily accessible place (remember you only have five seconds or so to reach in and turn it off) but must be out of sight to anybody looking for it — from inside or outside. The intruder may risk a few seconds of horn blowing if he feels he has a good chance of finding the switch. One idea is to fit a push-on, push-off switch underneath the floormats — in a position where the feet would not normally lie — such as between the brake and clutch pedals.

In this case, there would be no chance of anyone finding the location of your switch — simply because you never reach for anything, but simply trip the switch when you get into the car.

Two switches in parallel may be wired so that the alarm is able to be turned off from the passenger's side — very important if you are ushering guests into the car. However, this arrangement may not be without its problems, requiring a certain amount of commonsense to ensure that both switches are not left in the "on" position, resulting in a false alarm when the car is re-entered.

With the installation finished, it is time to set up the alarm. With a multimeter, check the voltage at the emitter of TR1 and set the exit time. Similarly, the entry time can be set. If you wish to change the "horn on" time, it is best to do this before installation. The 1M resistor can be lowered in value till the required time is reached. It can be as low as 10k for 30 seconds "on" time. Any time below this is generally considered unsatisfactory as a deterrent.

And that's just about it for this month. Next month we will show a small modification to the alarm which will give the horn a "beep beep beep . . ." action instead of a single long note. Such an alarm is far more attention getting.

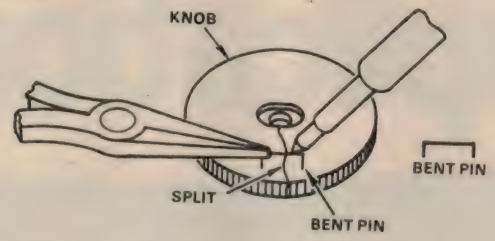
Elementary Electronics Ideas Worth Trying

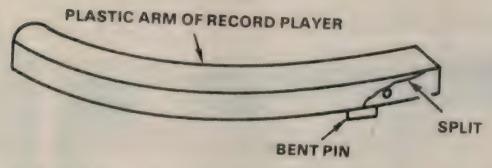
Plastic Repairs

I have found the following technique very effective in repairing broken plastic parts which can no longer be replaced. Very often the ability to repair such a part means the difference between salvaging an entire piece of equipment, or discarding it.

One recent job was to repair a volume control knob from a portable radio. It had split from the centre out and rotated on the shaft no matter how hard the retaining screw was tightened.

I took a household pin, cut the head off, and bent a right angle about an eighth of an inch from each end, making it into a very shallow "U".





The knob was held in a vyce in such a manner as to close the split. The pin was heated with a soldering iron and, while still hot, forced into the plastic. It is usually possible to force the pin below the surface and, while the plastic is still soft, draw it over the pin. When the plastic is cooled it can be smoothed off with glass paper and is "just like a bought one."

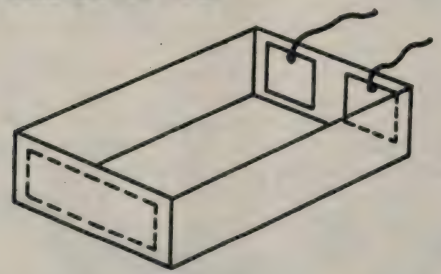
I have used this technique several times with great success, including one on a record player arm where the split ran across the hole for the pivot support pin. In this case I supplemented the joint with Araldite, but fitted the pin to take most of the stress.

(Mr K. Rowe, 15 First Avenue, Fivedock NSW, 2046.)

Low-cost Battery Holder

Penlite cells are popular sources of power for small experimental projects, but providing a holder for them often presents a problem.

I have found that a match box makes a very good holder for two of these cells. All that is needed is the match box tray, three pieces of metal and two wires.



The two wires are soldered onto two small pieces of metal to make the main terminals. The other piece of metal is larger and forms the connection between the two cells. Glue holds the pieces of metal in place. (Mr L. Roberts, 1 Bruce St. Mitcham, Victoria.)

Rubber Feet

An easy replacement for rubber feet is an set of rubber grommets mounted in the usual way near the corner of the chassis. This idea can be used in all situations where rubber feet are normally used, and often gives more "slip-proofing" than standard rubber feet. (Mr M. Fletcher, Pakenham, Vic.)

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CLASSICAL RECORDINGS

Reviewed by Paul Frolich

The Bartered Bride—Bamburg Symphony Orchestra

SMETANA — The Bartered Bride. (complete opera). Marcel Cordes, Nada Puttar, Pilar Lorengar, Ivan Sardi, Sieglinde Wagner, Fritz Wunderlich, Gottlob Frick; Bamberg Symphony Orchestra, conductor Rudolf Kempe. World Record Club stereo S/4518-9-20.

This is the only full recording of The Bartered Bride currently available; the only other I know of is a Czech one made about 1953, monophonic and no doubt long deleted; this one, a German HMV, dates from about 1963 and is very good, with marvellous lively stereo, a great degree of presence and plenty of stage illusion thrown in.

The opera — about which, more later — occupies only five of the six sides in this set. The last side contains a series of operatic recordings by Gottlop Frick: two of Hagen's arias from Wagner's "Twilight of the Gods" (Berlin Opera, Konwitschny); Falstaff's aria from Nicolai's "Merry Wives" (Bavarian State Opera, Heger); the "Porter" song from Flotow's "Martha" (Berlin Symphony, Klobucar); and "In diesen heil 'gen Hallen" from Mozart's "Magic Flute" (Berlin Symphony, Gruber).

This last side is a grand bonus and provides a wonderful survey of Frick's work; in tragedy as in comedy, one of the truly great basses of our day. More importantly, however, this bonus-side is quite a good indicator to the style and quality of the opera recording itself. The action, and the music, are heard to revolve as much around Kecal, the marriage-broker sung by Frick as around the much-tried lovers.

Also, this collection of German arias serves as a useful warning to anyone who might expect an idiomatic performance of this Czech peasant opera.

Don't get me wrong: this IS a fine performance and I would welcome it even if it was not the only one available. In some ways it is, perhaps, too good — the kind of performance one might get if the Metropolitan Opera Company undertook HMS Pinafore. The performance is sung in German — perhaps a very minor point to all but the few who understand Czech and miss the fun of the indigenous text; in addition, the performance is a very German one, a trifle inflexible, a little humourless, utterly correct and bloodless.

What faults I have to find with this performance are relatively minor ones beyond what I said above. Miss Lorengar is not always in pitch and her voice gets a little edgy in places; Wunderlich is rather too heroic for the part of Jenik and the orchestra is, after all, only a provincial one and must be forgiven for sounding slightly provincial.

But the recorded sound is so good and the actual blemishes are so minor that this set can only have one's warmest welcome — unless, that is, one has had the good fortune of hearing this work performed by Czechs in their own language.

★ ★ ★

BEETHOVEN — The complete cello sonatas. No 1, F major, op 5 No 1; No 2, G minor, op 5 No 2; No 3, A major, op 69; No 4, C major, op 102, No 1; No 5, D major, op 102, No 2. Paul Tortelier, cello; Eric Heidsieck, piano. HMV 2-record set, stereo SLS 836, with leaflet.

When I visited Europe in 1966, I made a special detour to Rheims; I had heard a great deal about Eric Heidsieck, then considered one of the finest Mozart and Debussy interpreters and this seemed to be my only hope of hearing and meeting him.

Not only did I get a friendly reception and a lot of the fine champagne made by Eric's family, but I had the good fortune of hearing him, and his pianist-wife Tania, play for some hours — Mozart, Beethoven, Schumann and Debussy. He was, then barely thirty years old, but highly acclaimed, and justly so, in France, Germany and the United Kingdom. In the years since, judging by recordings, his musicianship has been further refined and he must be counted as one of the greats among today's artists.

While Heidsieck, in his recordings, has been heard either by himself or with orchestra, Tortelier has had other partners in the past, notably with the Schneider Quartet and, in sonatas, with Aldo Ciccolini. Though he is Heidsieck's senior by at least a decade, these two great French artists make the perfect team for the Beethoven cello sonatas.

There is indeed, a great deal to admire in this set, principally perhaps the relaxed air of spontaneity. Both artists play without any evidence of pressure or nerves, intent on their own pleasure in music-making.

This approach is most appropriate in the two delightful sonatas of opus 5; I am aware that some listeners will regret the apparent absence of dramatic tension in the later works. All the same, the approach of these artists is arguably right for this music and wholly justifiable on the grounds of agreeable sound — a characteristic often absent in cello recordings.

Having thus praised the performance and, I believe, rightly, I must mention a few reservations. The use of separate microphones for the two instruments was, I think, a mistake as it interferes with the balance as heard by the performers. The other drawback, if only marginal, is occasional bad intonation from Tortelier, brought about by moments of apparent abandon. These mistakes, if mistakes they are, are far from prominent and should not interfere with anyone's true enjoyment of this great music, so well played and successfully recorded.

★ ★ ★

ENGLISH STRING MUSIC — Academy of St Martin-in-the-Fields, directed by Neville Marriner. HOLST: St Paul's Suite; DELIUS: Two Aquarelles; PURCELL: Chacony in G minor; VAUGHAN WILLIAMS: Prelude "Rhosymedre;" WALTON: Two Pieces from "Henry V;" BRITTEN: Simple Symphony. HMV stereo OASD 2831.

It is no more than about three decades ago that Dr Boyd Neel gave most of us our first taste of a string orchestra; music has come a long way since then — via the Stuttgart Chamber Orchestra, the Bath Festival Orchestra and others. Now, every sizeable town has one or more permanent ensembles of this kind.

It may be something to do with the traditional British talent for understatement — whatever the reason, England has provided us with the two groups which are probably the best all-rounders at present: the English Chamber Orchestra and this group, both of whom have been heard in Australia.

The collection presented on this disc, ranging from the well-known Purcell piece to the previously unrecorded Vaughan Williams, suggest that the English repertoire is singularly well suited to the development of such ensembles. There is, indeed, a clear trend, based on the dance and influencing English music in every period.

As usual with Marriner, all the music on this disc is treated with exuberant romanticism and made to sound lively and full of interest. The performances in themselves are not unique ones; yet, I know of no better version of the lovely St Paul's Suite nor, indeed, the other pieces excepting perhaps the Britten, in which the composer's own version seems the more persuasive.

One may, of course, have reservations about this type of collection and it will not attract everyone; unless you are opposed to the music itself, the disc will give utter satisfaction, I think. The playing is brilliant and the recorded sound rich and full.

★ ★ ★

BARTOK — Mikrokosmos. Huguette Dreyfus, harpsichord. Record Society stereo S 6439.

This is the most fascinating keyboard recording I've come across for a long time. Mikrokosmos, composed between 1932 and 1939, is a collection of about 150 short pieces, ostensibly written for performance on the piano. They are contained in six volumes and I regret to have heard no more than perhaps half of these pieces.

Although all these pieces have usually been thought of as belonging to the piano, I have heard some in transcriptions for strings and even for orchestra. I did not know that Bartok, in his prefatory notes, had suggested the suitability of certain pieces for performance on the harpsichord without specifically limiting the number of such pieces.

It is, of course, idle to speculate on whether Bartok would indeed have cared for what we get to hear on this disc. It must be remembered that, in the 1930s, the building of harpsichords was not nearly as advanced as it has now become.

Julian Russell will be overseas for the next few months, and in his absence, Classical Recordings will be reviewed by Paul Frolich.

CLASSICAL RECORDS

Miss Dreyfus, playing a modern instrument built by Neupert, made the transcriptions heard on this disc. They are very much to my taste and I believe that they are indeed what Bartok himself would have done, had he been able to obtain so fine an instrument. I can only say that I have not heard Bartok's late keyboard pieces to greater advantage.

The disc, apart from being one of the best harpsichord recordings I know of, may well help some stubborn diehards to an easier acceptance of Bartok's music and musical ideas. It is the virtue of the harpsichord that musical lines emerge more clearly and that sounds which might seem harsh on the piano are found to be sensual.

This is beautiful music, superbly played and well recorded. Moreover, this is one of these rare occasions when an out-of-the-way overseas item is given Australian release — the Record Society, in obtaining this recording from the Harmonia Mundi catalogue, is really doing its members proud!

★ ★ ★

TCHAIKOVSKY — The Nutcracker (complete ballet). London Symphony Orchestra, conducted by Andre Previn. 2 HMV stereo SLS 834.

Except when attending the ballet, live, many years ago, I'd never heard a complete performance of this music, live or on disc. All I knew (and I dare say that goes for most listeners) was the "Suite" which contains about one-fourth of the ballet's material and discs of "excerpts." The Suite, op 71A, is by Tchaikovsky; the excerpts are anyone's — the best-remembered being those arranged by Spike Jones in the 1940's on, if I recall correctly, eight sides of 78s!

Although I got a lot of enjoyment out of this two-disc set, I really don't think it is for general music-lovers — rather for Tchaikovsky specialists and utter ballet-omanes. The music is really charming, including some of the rarely heard pieces, and far from boring despite the overall length — melodically each piece is novel and self-contained and most items are too brief to have allowed any turgidity to creep in. In fact, they present Tchaikovsky's inventiveness and skill at their highest.

Despite what I've said: four sides is rather a lot and I certainly don't recommend taking it all at one sitting — that way lies indigestion. The performance by the LSO is exemplary, both in breadth and in detail; Mr Previn's conducting is both meticulous and imaginative and the recorded sound and stereo balance of the highest standard.

★ ★ ★

MOZART — Piano Concerto No 22 in E flat, K.482; Concert Rondo in D major, K.382. Daniel Barenboim, piano and conductor, with The English Chamber Orchestra. HMV stereo OASD 2838.

Listening to this recording has been a pleasure but, also, a rather disturbing experience. Barenboim, then only 22 years old, recorded this same concerto in Vienna in 1964, with Laszlo Somogyi conducting. The recording, by Westminster, was briefly issued in Australia by the Universal Record

Club and it so happens that I still treasure it.

Although a beautiful and accomplished work, this concerto has not fared well in the LP age. Apart from an old Lili Kraus version (with poor orchestra and sound) on Vox, the 1964 Barenboim is the best I've known to the present. This new version has many virtues — not least the intimate integration of orchestra and solo piano, brought about by Barenboim's dual role. Conducting from the keyboard is not always a safe undertaking; Barenboim is one who can risk it and the ECO respond to his every whim with joy and pride.

Make no mistake: whims there are aplenty. Freed from the restraints an older conductor, such as Somogyi, might impose, Barenboim gives free rein to his romanticism. The results are, in turn, enchanting and infuriating. There is, to me, a quite unjustifiable cadenza by Barenboim in the 1st movement — a real kitchen-sink spit of a one. On the other hand, there are moments of quite exquisite sensitivity, especially in the slow movement.

A detailed analysis of a standard concert work would be pointless; I've said enough to indicate that this will be not be to the liking of all Mozartians. At the same time, I know of no available recent recording of the work which is anywhere near as good as either recording or performance.

The Concert Rondo K.382, previously not known to me, is a work of charm rather than of great inspiration. It makes very pleasant listening in any event, a welcome filler with novelty value and it, too, is excellently played.

★ ★ ★

WALTON — Belshazzar's Feast; Improvisations on an Impromptu of Benjamin Britten; John Shirley-Quirk, baritone; London Symphony Orchestra and Chorus, conducted by Andre Previn. Angel quadraphonic Q4 SAN 324 (also on stereo SAN 324).

The "Improvisations . . ." which open this recording is Sir William Walton's 1970 tribute to Britten; a type of very free variations, it tells us more about Walton than about Britten. The basic melodic material was Britten's, but the complex and rich orchestral sound is wholly and unmistakeably Walton's. A very fine piece, it is excellently played and most welcome.

"Belshazzar's Feast" remains one of the greatest of all choral works and I don't think I will ever fail to respond to its expressiveness or to the unique volume of orchestral sound it unleashes. There have not, to my knowledge, been any wholly bad performances of this great work on disc, though Ormandy's of a few years back was a bit clumsy and overblown. In any case, this performance is magnificent, in no way inferior to that directed by Sir William himself and, here and there, actually to be preferred to it.

Previn's quick rise to the front-rank of conductors has rested on solid work and convincing readings of great (and far from easy) works; this is one of the best yet and sure to gain him many more admirers.

This is the first quadraphonic disc I have reviewed; the record is of the SQ matrix type and it is only right to mention here that the much more expensive "discrete" system of quadraphonics is the superior one. However, I own neither one nor the other and am not yet convinced of the necessity for such equipment, given my restricted musical tastes.

If I was likely to listen to works such as "Belshazzar" with great frequency I would, I believe, invest in a modern quadraphonic system without delay. There isn't the least doubt that the system greatly enhances one's pleasure and appreciation — there is not only a sense of being inside the music but, also, far greater clarity. With music of such complexity, it is indeed exciting to be able to separate individual strands and then hear them merge again.

Both the precision and the opulence of the playing are better to be judged on such a quadraphonic disc — there is a definite, though not tragic, loss when the disc is played through a conventional stereo system. One final word: John Shirley-Quirk is in wonderful voice and by far the best soloist I've ever heard in this work.

In honour of Walton's seventieth birthday, this year, this recording is one every music-lover should hear; it may well become a standard of excellence for years to come.

★ ★ ★

MUSSORGSKY — Boris Godounov (Opera excerpts). Gottlob Frick, Martti Talvela, Rudolf Schock, etc; Choir and Orchestra of the German Opera, Berlin, conducted by Lovro von Matacic. Ariola-Eurodisc (Festival) stereo 80011.

Although this disc of excerpts (four scenes) can hardly be described as the last word on "Boris," it includes some very remarkable performances. This opera is wholly Russian in musical content and I doubt that its full flavour could emerge in a German version, however good the individual contributions.

Apart from very fine orchestral playing and a beautifully engineered sound, the highest prise is due to Frick, in the name-part. His tragic feeling and dramatic style are utterly convincing; though he sings in German, I find his Boris at least as moving as Boris Christoff's. The other bass part, that of Pimen, is sung rather less successfully by Talvela; this is a pity — in the two Christoff versions, the Bulgarian bass tackled both parts himself and one could wish Frick had done likewise.

All other discs of "Boris" excerpts known to me end with Boris' death; this one continues with the "Revolution" scene which, dramatically as well as musically, is rather a let-down. Although I might regret this particular arrangement, it is redeemed by the lovely tenor voice of John van Kesteren; singing the small part of the Idiot, he brings the recording to a moving end.

On the whole, I think "Boris" is too beautiful and important a work to be treated as a collection of fine tunes. If there are to be excerpts, ones from idiomatically first-rate performances — such as those by Christoff or Ghiaurov — are probably to be preferred. All the same, I found this an interesting and worthwhile experience and I am, once again, full of admiration for Gottlob Frick and his versatility.

★ ★ ★

DELIUS — Paris (The Song of a Great City); Eventyr; Dance Rhapsody No 1. Royal Liverpool Philharmonic Orchestra, conductor Charles Groves. HMV stereo OASD 2804.

To listeners of my generation, Delius' music always raises the ghost of Sir Thomas Beecham, without whose devoted sponsorship this composer might have remained half-forgotten to this day. When we hear a performance of a work such as "Paris," the standard of comparison is, therefore, almost automatically Beecham's.

After this preamble, I will hardly be expected to acclaim Groves and his Liverpudlians as greater than Sir Thomas and his own Royal Philharmonic Orchestra. And I don't think they are better but: they are every bit as good!

There will never be another Beecham and none else should be expected to conduct Delius quite as he did. Groves may, as it happens, be closer to the true spirit of Delius in these works. Where Sir Thomas was wilful and made his own tempi as it suited him, Groves seems to me to be able to achieve greater lyricism — the quality I most treasure in Delius' music.

A more detailed comparison of the two conductors' ways with Delius shows differences of surprising magnitude. Where Sir Thomas revelled in the sound of brass, Groves remains concerned to allow the strings a clear space in the spectrum and Groves' tempi are more evenly contrasted.

The playing of the two orchestras is not, I think very different. But, where Beecham had only mono, Groves has stereo sound and that makes things sound a great deal more interesting. For my part, I'd want to have both versions available to me — but if you have not been able to get the Beecham, this one will prove quite adequate.

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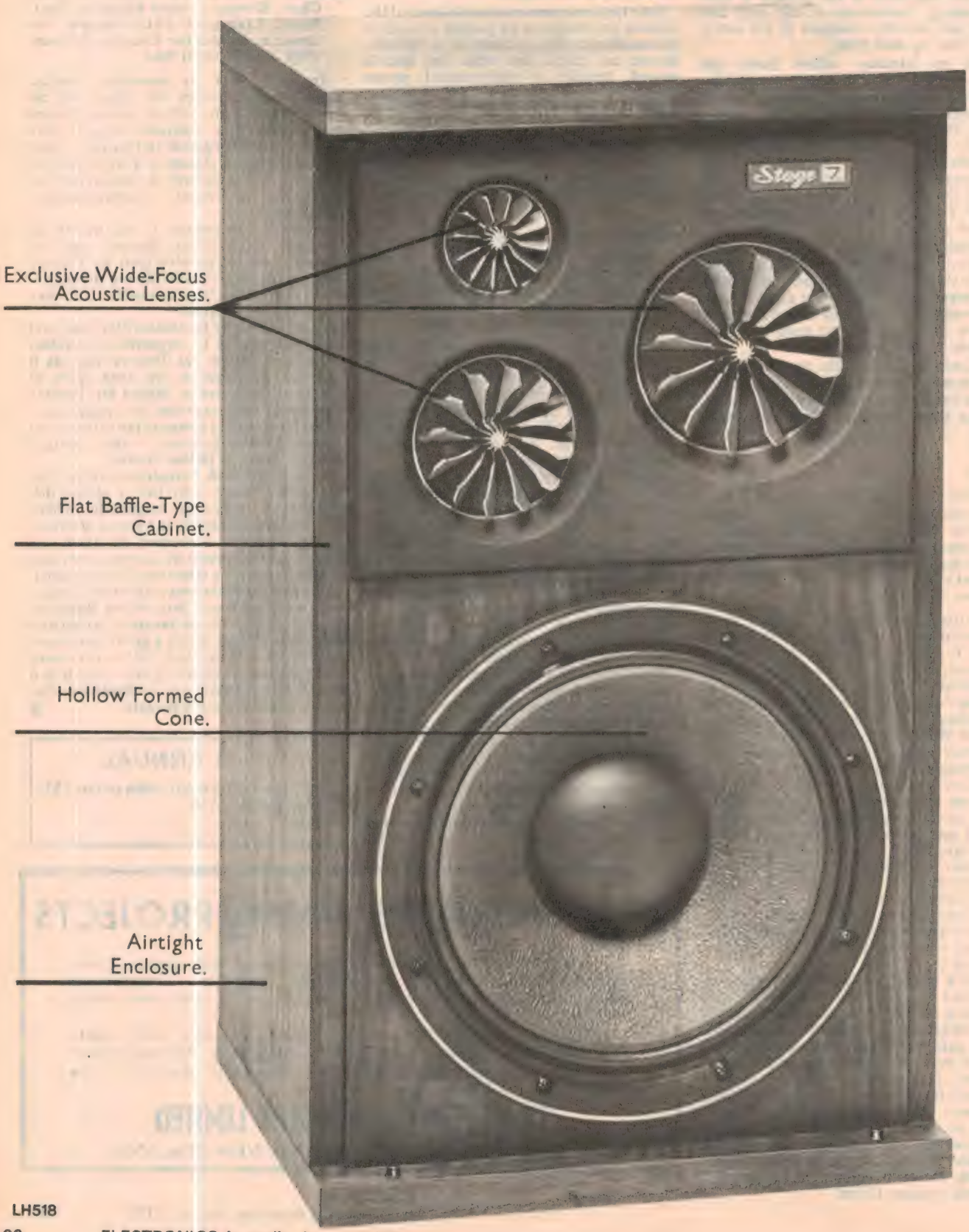

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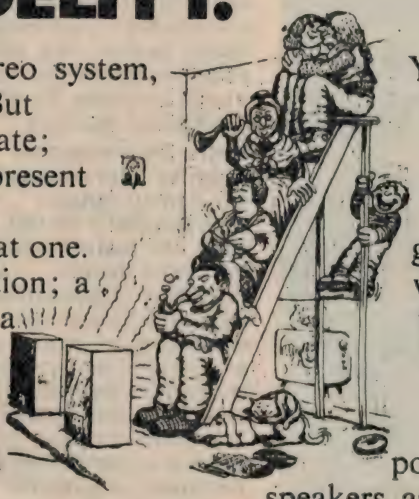

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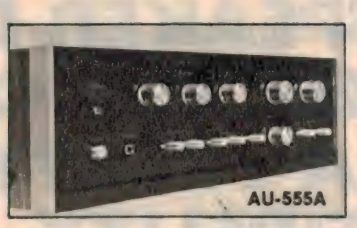

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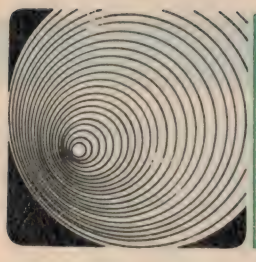

VARIETY FARE

REVIEWS OF OTHER RECORDINGS

Devotional Records

THIS IS THE DAY. The Cameron Family. Stereo, Shiloh SP-373A. (From Shiloh Productions, PO Box 379, Hurstville, NSW 2220. Price $5.95 plus 40c postage and pack).

Although previously not known to me, the Cameron Family comprising father, mother and three daughters have travelled extensively spreading the Gospel in word and song. New Zealand, Canada, Fiji, Mexico and the USA have been on their itinerary, over and above their native Australia.

Their sound is fairly typical of a talented family or Gospel team — sincere, spontaneous, with obvious platform appeal, but just lacking the ultimate polish and production of a commercial assembled team. But, having made the point for those who may tend to listen critically, let me simply say that as a Gospel team they are good.

A covering letter from Murray Cameron explains that, for the recording, his family had the backing of a chorus and John Harding's string quartet, with arrangements by Warren Judd. The recording was made, using the facilities of EMI, Sydney, including a 16-track recorder and a Dolby system. Certainly the sound quality is excellent.

Track titles: There Never Was A Day — As The Hart Panteth — It's Jesus, He's Coming For Me — There's A Sweet, Sweet Spirit — Do You Really Care? — That's All I Need — Amazing Grace — Somebody Bigger Than You And I — One Thing Have I Desired — Therefore Being Justified — Lovest Thou Me? — I Wish We'd All Been Ready.

Those who have heard the Cameron Family will certainly be interested to learn of the release of this album, as may many others. (W.N.W.)

★ ★ ★

SUNSHINE DAY. The McCrary. Light LS-5605-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

McCrary is the family name of twelve negro brothers and sisters from Ohio. Five of them — three brothers and two sisters — are associated in this talented family Gospel group. Backed by unnamed rock instrumentalists, they present a program mainly of their own compositions:

Sunshine Day — I Never Was So Happy — Get Yourself Together — Today Is The Tomorrow — He Touched Me — — Jesus People — Pray — You're Not The Only One — Your Life's At Hand — Let It Start With You.

Based on the rock idiom, with obvious and expected overtones of negro Gospel, the McCrary sound will appeal mainly to those with modern tastes or an ear for jazz and rock — the more so because the emphasis is much more on the sound than the diction.

But, if you do buy, you'll not be disappointed in the technical quality of the sound. (W.N.W.)

★ ★ ★

DAVE PETER'S HERITAGE. Stereo, Medallion MS-7301. (From S. John Bacon Publishing Co, 119 Burwood Rd, Burwood 3125. $3.95.)

To judge by the picture, Dave Peter's group consists of three girls and three fellows, whose Gospel message is delivered in a gentle rock style that should appeal to the young without upsetting the oldies.

Two or three of their numbers are adaptations of traditional hymns but the rest will probably be new to you: Back Where I Started — I Need Thee Every Hour — Love Is The Way — Hello God — Shout For Joy — My Jesus I Love You — More About Jesus — Love Is Pure — Benediction.

I gather from the jacket note that hymns used by Dave Peters are available from the publishers of the record: Medallion Music Corporation.

The production is smooth and the sound quality from this American album is very clean. If you want a Gospel album that combines modern sound with old-fashioned restraint, this one is safe buying. (W.N.W.)

Instrumental, Vocal and Humour

PROKOFIEV. Classical Symphony in D, Op 25. TCHAIKOWSKY. Serenade in C for Strings, Op 48. Vanguard Quadraphonic VSQ 30016.

Prokofiev's Classical Symphony is thought by many to be a musical joke but to treat it as such is to give it poor justice. Rather it should be listened to as a clever work full of logic and charm. The young listener, reared on some of the more enterprising pop music should appreciate it well.

Tchaikowsky's Serenade in C for Strings is a cross between a symphony and a ballet. It has a symphonic form but the famed ballet director George Balanchine has created a successful ballet to the music entitled simply "Serenade." Either way, it is a delightful piece of music.

Featured orchestra is the English Chamber Orchestra which has earned a very high reputation under the direction of Daniel Barenboim. On this album they are conducted by Johannes Somary and they perform beautifully throughout.

Sound quality is excellent although I did not listen to the disc through a four-channel set-up with SQ decoder. Buy it for the music. (L.D.S.)

★ ★ ★

NEW YEAR IN VIENNA. The Vienna Philharmonic Orchestra, conducted by Willi Boskowsky. Stereo, Decca SXLA 6572.

The New Year's Eve concerts entirely devoted to Viennese music conducted by Willi Boskowsky are now a tradition in Vienna, and recordings of such events are issued annually. However, the sleeve carries the information that the recording was taken in the Sofiensaal, Vienna in April 1972, which makes the title of this disc rather pointless. Apart from this small quibble, I can recommend this delightful pot pourri of light-hearted Viennese music with considerable enthusiasm to those for a taste with this line of music. There is no finer combination in the world for this music than the Vienna Philharmonic and Boskowsky.

The program includes such perennial favourites as the Morning Papers Waltz — Thunder & Lightning Polka — Explosions Polka — Persian March (all by Johann Strauss II); Gold and Silver Waltz (Lehar); The Beautiful Galatea Overture (Suppe). Other items by Strauss are included, as well as some by Josef Strauss and less prominent composers. Sound and stereo are first rate. (H.A.T.)

★ ★ ★

ALFRED BRENDEL PLAYS ... Piano music of Beethoven, Schubert, Liszt, Balakirev. Alfred Brendel, piano. Stereo, Decca "World of the Great Classics" series SPA.249.

Alfred Brendel is still relatively young (42 years old) and the fact that some tracks in this selection are "electronically reprocessed for stereo" indicates the already impressive length of his recording career. The program comprises — By Beethoven: Pathetique Sonata — Bagatelle No 1 in G minor, op 119 — Six Variations on Turkish March from "Ruins of Athens" — Fur Elise. By Schubert: Impromptus No 2 in E flat and No 3 in G flat, op 90 — Moment Musical No 3, By Liszt: Hungarian Rhapsody No 11 in A minor — Paganini Etude No 3 in A flat minor. By Balakirev: Islamey (Oriental Fantasy).

Undoubtedly, Brendel has a most impressive technique, which is best seen in the more brilliant passages in the Schubert, Liszt, and above all the Balakirev, works on side 2. However, I could find little to admire in his Beethoven playing on side one. The opening passage of the "Pathetique", is marked "Grave" but I hardly feel Beethoven intended it to sound as heavy and dull as here. The Andante Cantabile is thrown away as a worthless trifle (a common fault with many pianists, probably because it has relatively few technical difficulties) and the concluding Rondo is lacking in the sparkle and dash one expects to find. The remaining items by Beethoven are student pieces and are played as such,

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

without any noticeable attempt at serious interpretation. As mentioned above, the music by other composers on side 2 is much more enjoyable. The disc has clean but dated sound, and the virtually unnoticeable stereo spread common for solo performances. (H.A.T.)

★ ★ ★

KARAJAN EXPRESS — VIENNA. Music of Mozart, Schubert, Beethoven, Johann Strauss I & II, The Berlin Philharmonic Orchestra, conducted by Herbert von Karajan. Stereo, DGG 2727 006 two disc set.

KARAJAN EXPRESS — PRAGUE. Music of Dvorak — Smetana. Performers as above. Stereo, DGG 2725 002, two disc set.

Here are two releases in a series in which Herbert von Karajan conducts music associated with various European cities and countries. Beautifully packaged in glossy folding sleeves, they are certain to attract large numbers of buyers, particularly those who put their faith in the DGG company's reputation for a high quality product, and in von Karajan's reputation as an outstanding conductor. The special price of $7.96 for the two disc sets should be a further attraction. And the Berlin Philharmonic can certainly be rated as one of the world's great orchestras. What more could you ask? Here, then, is what each set contains:

VIENNA: Emperor and Blue Danube Waltzes (J. Strauss II) — Radetzsky March (J. Strauss i) — Divertimento No 2 (Mozart) — Serenade No 6 (Mozart) — Symphony No 8, "Unfinished" (Schubert) — Symphony No 8 (Beethoven). Most potential buyers will presumably be familiar with these very well known works, although they may know the Mozart Serenade better by the title "Serenata Notturna."

PRAGUE: Vysehrad and The Moldau, from "My Country" (Smetana) — Five Slovanic Dances (Dvorak) — Symphony No 9 "From the New World" (Dvorak).

I suppose learned musicologists will continue to find fault with some aspects of von Karajan's performances of all the works listed above, but I thoroughly enjoyed every moment. All sections of the Berlin orchestra are admirable, and I doubt whether any other orchestra in the world would surpass their playing of Beethoven. If the titles are on your list of requested music, buy with confidence.

Also available in this series:

FRANCE: 2725 004. Symphinie Fantastique (Berlioz) — Coppelia Ballet Suite (Delibes) — La Mer (Debussy).

RUSSIA. 2725 005. Pictures at an Exhibition (Moussorgsky) — 1812 Overture (Tchaikowsky) — Symphony No 4 (Tchaikowsky).

Italy: 2725 003. Cavalleria Rusticana, highlights (Mascagni) — I Pagliaci, highlights (Leoncavallo) — Sonatas for Strings Nos 1 and 6 (Rossini) — Intermezzos from La Trviata (Verdi), Adriana Lecouvreur (Cilea), Suor Angelica (Puccini), I Pagliaci (Leoncavallo), Feodora (Giordano) and Manon Lescaut (Puccini) (H.A.T.)

★ ★ ★

UNFINISHED SYMPHONY with Rosamunde and Marche Militaire — Schubert. The Vienna Philharmonic Orchestra with various conductors. Stereo, Decca SPA 225.

The Viennese orchestras are always at their best with Schubert and there is some fine playing in this disc released on Decca's "World of the Great Classics" ($2.99) series. I feel it is unlikely that there is a better performance of the symphony on a budget priced disc. The depths of feeling reached by the orchestra under Carl Schuricht cannot fail to move a sensitive listener. Unfortunately, a particularly inappropriate choice of a fill for side 1 moves one abruptly from the deep tragedy of the symphony's slow movement directly to the toy soldier parade ground of the "Marche Militaire."

Side 2 is taken up by the charming ballet music from "Rosamunde," where that fine conductor, the late Pierre Monteux, gives a splendidly rhythmic performance that never lets us forget that this is music for dancing.

Unfortunately the sound quality is below par. Distortion is particularly noticeable on side 2. (H.A.T.)

★ ★ ★

SOUSA MARCHES. Boston Pops Orchestra conducted by Arthur Fieldler. Stereo, RCA Camden CAS-2593.

The jacket notes explain that each concert of the Boston Pops conducted by Arthur Fielder customarily begins with a march —

perhaps to provide a stirring opening, perhaps to give the audience time to settle. On this album are eight of the marches that have formed part of this custom:

El Capitan — High School Cadets — The Thunderer — Semper Fideles — Washington Post — Stars And Stripes Forever — Boston Commandery — American Patrol.

The combination of so well known a conductor and orchestra must catch the eye at the Camden budget price, although some may prefer this kind of material from a band rather than an orchestra. Playing time is about 12 minutes per side and the sound quality is normal. (W.N.W.)

★ ★ ★

ORGAN SYMPHONY (Symphony No 3 in C Minor, Op 78), Saint Saens. City of Birmingham Symphony Orchestra conducted by Louis Fremaux. Christopher Tobinson, organ. Columbia Studio 2 quadraphonic 04-TWO-404.

Composed in 1866 and dedicated to the memory of Franz Liszt, Saint Saens Symphony No 3 calls for a full orchestra, plus grand organ, grand piano, piccolo, cor anglais, bass clarinet, double-bassoon and tuba. It provides a sound texture which lends itself to exploitation by the quadraphonic medium.

Encoded per an SQ matrix, the sound is inevitably of the surround variety and one is torn between the urge to turn the rear channels down to achieve predominantly frontal sound and the alternative of leaving them at normal level and being, as it were, a part of the orchestra. I chose the latter course and simply enjoyed being surrounded by sound, sometimes gentle, sometimes massive, but always clean.

And clean it is, with excellent definition and not a whisper of surface noise.

For those not familiar with the music, the detailed jacket notes cover the composer, the symphony, the conductor and the orchestra. The organ dominates the cover picture but no other details are given. But, all in all, it adds up to a record that you will be glad to have in your collection. (W.N.W.)

★ ★ ★

A CLASSICAL SHOWCASE. Golden Hour presents, Alshire stereo GH804. Distributed in Australia by Radio Corporation Pty Ltd.

That recent television commercial showing a bird in flight and then fading to a shot of a climbing airliner has certainly done much to popularise "Morning Mood" from the Peer Gynt Suite. This is just one reason why this "Golden Hour" Presentation is sure to sell well. As the name implies, it lasts for just over an hour making it good value. The first half is devoted to tunes from the Peer Gynt suite, played by the Hamburg Staatsoper Orchestra.

Side Two features Dukas' "Sorcerer's Apprentice" and Ravel's "Bolero" played by the London Philharmonic Orchestra. Manuel de Falla's "Ritual Fire Dance" played by the Nord Deutsches Symphony Orchestra concludes the album. Sound quality throughout the album is very good and surface noise was low. Needless to say, the performances left little to be desired. (L.D.S.)

ASTOR QUADRAPHONIC SAMPLER

QUADRAPHONIC SAMPLER. Astor Quad 4D Sound. QUAB-4001.

This is a sampler, rather than a demonstration disc, which means that the producers have not sought to put together a collection of way-out tracks. More than that, they have avoided a mix of highly dissimilar elements. The result is a collection of popular orchestral items from various sources and, as such, it adds up to very pleasant listening for those whose tastes run in that direction — and that probably means a major slice of the listening audience.

Here are the tracks, abbreviated to conserve space: Chirpy, Chirpy, Cheep (John McLeod orchestra) — Spinning Wheel (Dennis Lopez orchestra) — It's Too Late (Sounds Orchestral) — Waltz from Serenade For Strings (Victor Sylvester) — Danca Das Horas (Rogero's Brazilian Brass) — Oh You Pretty Thing (City of Westminster Band) — Raindrops (Button Down Brass) — She's Leaving Home (London Pops) — This Guy's In Love (David Snell) — Fantasia on Greensleeves (Geoffrey Brand orchestra) — Never On Sunday (Cyril Stapleton) — A House Is Not A Home (Tony Hatch).

Recorded to the Sansui QS format, the sound emerges with a fine surround quality, appropriate for this kind of material. (W.N.W.)

VARIETY FARE

THE LONDON BALALAIKA ENSEMBLE. Stereo, World Record Club S / 5260.

I enjoyed this disc when it was first released here on the Deram label. It is a first class production in every way, featuring some polished playing by an accomplished body of performers. The program, consisting of those soulful Russian traditional melodies, has been very well recorded. The titles are: Pedlar's Dance — At the Gates — Remember, Remember — In the Garden — Beyond the Fast Running River — Little Apple — Russian Dance — Kalinka — There is More Than One Path — Brightly Shone the Silver Moon — Oh You My Snowball Tree — Under the Apple Tree — My Meadows — Oh, You the Night.

By using the full range of balalaika and domra instruments, a full bodied tone has been achieved. It is a wonderfully effective sound. (H.A.T.)

★ ★ ★

THE WORLD OF ENGLAND. Various artists and orchestras. Stereo, Decca SPA.190.

The appeal of this disc will probably be mainly to expatriot Englishmen with nostalgic memories of their homeland, featuring as it does such titles as "O Peaceful England" and "The English Rose" from Edward German's operetta "Merrie England", "Fantasie on Greensleeves" (Vaughan Williams); and "Pomp and Circumstance March No. 1" (Elgar). As a lead in to the music there is the famous passage from Shakespeare's "Richard II" beginning "This Royal Throne of Kings" followed by a suitably patriotic burst of music in an excerpt from Walton's "Orb and Sceptre" coronation march.

Also included are: Shepherd's Dance from "Henry VIII" (German) — Pastoral Dance from "Nell Gwynn" (German) — Scarborough Fair — Early One Morning — The Floral Dance — Oranges and Lemons — Knightsbridge March (Coates) — Strawberry Fair — Eton Boating Song — Sussex-by-the-Sea.

Apart from the "Boating Song" and "Scarborough Fair," which is beautifully performed by folk singer Marianne Faithfull, the music is presented by orchestras and brass bands. The music is all very pleasant and well performed, but most of the tracks are fairly ancient (some are reprocessed stereo), so that poor quality sound will disappoint those who demand hi-fi as a pre-requisite to musical enjoyment. (H.A.T.)

★ ★ ★

LATIN HOLIDAY. 101 Strings Orchestra conducted by Les Baxter. Quadraphonic QS. Astor Gold QS-17.

With Les Baxter as orchestrator and conductor, the 101 Strings orchestra takes on a new role as background to a variety of percussion and wind-instruments appropriate to the title "Latin Holiday." Through the four channel medium, there's plenty going on, all of it recorded very cleanly. The eleven tracks include:

Que Mango — Tropicando — On A Warm Night — Flight In The Andes — Jungle Montuno — Boca Chica — Felicia My Love — Come Back To Paradise — Night In Buenos Aires — Morning On The Meadow.

As the notes suggest, it's a characteristic Les Baxter mix of European, African and Latin American, easy enough on the ear but with melodic themes that happen rather than flow. Perhaps you had better sample a track or two, in case there's another in the quad series that you'd prefer. (W.N.W.)

★ ★ ★

ALEXEYEV BALALAIKA ENSEMBLE. Stereo. Chapter 1 (EMI) CHS. 810.

If you bought and enjoyed the London Balalaika Ensemble which I reviewed on its original release a few years ago, and again recently when reissued by World Record Club, you will welcome the new release as a very good companion disc. It has two well known standards in "Song of the Volga Boatmen" and "Two Guitars", but apart from these the title will probably be unfamiliar. Two pieces were composed by members of the Ensemble ("Atalanta", based on a story from Greek mythology, and "Land of My Sixteenth Year," concerning the musings of an old peasant dreaming of his youth); and another track is an arrangement of a love song by Shostakovich.

The remainder are typical traditional peasant tunes arranged by the group.

The Alexeyev Ensemble are a fully professional body of musicians, with wide performing experience, and one does not have to be an expert to appreciate the high standard of their playing. Only instruments of the balalaika and domra families are used, but these range from the high pitched prima to the sombre double bass, and produce a satisfyingly full-bodied sound. All this adds up to a most satisfying disc which should please anybody with a taste for traditional music and instruments. The sound quality is quite satisfactory. (H.A.T.)

★ ★ ★

THE BEST OF LAURINDO ALMAIDA. Stereo. Capitol SENC.9976.

This is a collection of tracks from previously issued Almeida discs, some of them more than 10 years old: Moonlight Sonata, first movement (Beethoven) — Arioso (Bach) — Claire de Lune (Debussy) — Schon Rosmarin (Kreisler) — Pavane for a Dead Princess (Ravel) — Farucca (Falla) — Preludes Nos 2, 5, 8, 10, 11, 12 (Ponce) — Fandanguillo (Turina) — Tango Espanol (Albeniz). Technically, Almeida cannot equal the leading guitarists now recording, but he is certainly capable of providing a pleasureable performance, and no doubt his many admirers will find plenty to enjoy in this selection. The age of the recordings shows in the sound quality. So don't expect the ultimate in hi-fi. However, the sound is clean enough and should satisfy all but the most critical. (H.A.T.)

★ ★ ★

SOUSA MARCHES. Men O' Brass. Conducted by Harry Mortimer. Studio 2 stereo TWO 385.

There are several facets to this album which add interest to a fine presentation of Sousa marches. The first is that "Men O' Brass" are joined by the City of Coventry Band who have as musical director Albert Chappell. They add to the Fairey Band and the Foden's Band to form a mighty ensemble.

Apart from the two celebrated marches "King Cotton" and "El Capitan" and a clever medley called "Semper Sousa", the marches on this album have never been recorded by Brass Bands before. They are all excellent and Sousa fans are well advised to listen and buy. Sound quality is outstanding.

The nine remaining tracks are: The Picador March — The Corcoran Cadets — The Directorate March — Fairest Of The Fair — Beau Ideal — The Freelance March — National Fencibles — Our Flirtations — The Occidental March. (L.D.S.)

Whistle while you work

24 GREATEST POLKAS. Lawrence Welk & Myron Floren. Stereo, Interfusion (Festival) IFTL-267/8. Two-record set $7.95.

This is an excellent record to do household chores by — I know, because I was just so engaged while to four sides were playing! For deliberate listening, one might come up with a different verdict, because the format and tempo remain virtually unchanged from beginning to end. But, as background, to which you don't expect to listen deliberately, except when a tune grabs your attention, it's a happy workaday sound.

Without attempting to list the twenty-four tunes, they include the inevitable Beer Barrel Polka, Tavern In The Town, Kit Kat, Champagne and so on.

The quality and surface is good. (W.N.W.)

★ ★ ★

CLASSICS GO LATIN. Brian Fahey and his Orchestra. Studio 2 Stereo (EMI) TWO 392.

The title is sufficiently indicative of the contents. The collection of classical tunes is presented in the typical modern style, with Latin American rhythm, and comprises: Ritual Fire Dance (Falla) — Air on the G String (Bach) — Scherzo from Midsummer Night's Dream (Mendelssohn) — None But the Weary Heart (Tchaikowsky) — Ave Verum Corpus (Mozart) — Toreador's Song from "Carmen" (Bizet) — Overture to "Marriage of Figaro" (Mozart) — Solveig's Song (Grieg) — Gavotte (Popper) — Themes from "Polovtsian Dances" (Borodin) — Ave Maria (Bach-Gounod) — Themes from "Capriccio Italien" (Tchaikowsky). There have been many discs of this type, but the high standard of musicianship and the clever arrangements lifts this one above the average, and the high quality sound adds to its attractions. (H.A.T.)

★ ★ ★

MORNING HAS BROKEN. Tony Fenelon playing the Conn Theatre Organ. Stereo. Festival FL34814.

Melbourne organist Tony Fenelon continues to add steadily to his growing list of long playing albums — and to his standing as a popular organist. The instrument used for this one is the Conn 650 electronic theatre model, an instrument which can very closely simulate the sounds of its pipe counterpart. In this recording the instrument tends to lack some of the sparkle that it has "in the flesh", possibly because some of the tracks, at least, have been re-recorded to include additional parts played on piano by the same artist.

The twelve tracks comprise: Yellow Bird — Sentimental Journey — Early In The Morning — Skye Boat Song — Sweet Sue — That's Entertainment — Anna — If I Ruled The World — Windmills Of Your Mind — Les Bicylettes De Belsize — Black Bay Shuffle — Morning Has Broken.

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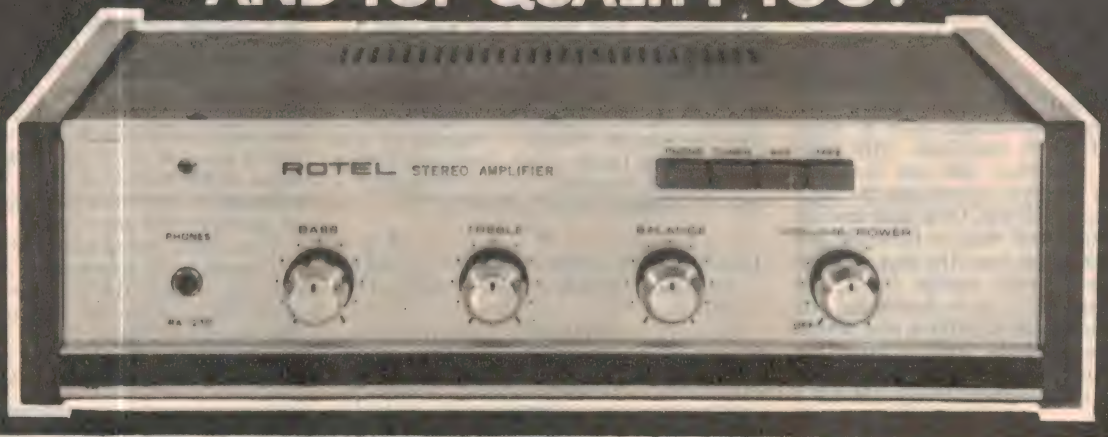

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VARIETY FARE

On both organ and piano, Tony Fenelon exhibits all the skill and musicianship that we have come to expect of him and the album makes for pleasantly varied listening. It's just a pity that the recording itself doesn't have a trifle more presence and "sparkle". (W.N.W.)

★ ★ ★

MUSIC FROM WALT DISNEY'S FANTASIA. Various orchestras and conductors. Decca Phase 4 Stereo PFS 4260.

This is not music from the sound track of the film as the title might be misconstrued. The only close connection with the soundtrack is the performance by the London Symphony Orchestra under Leopold Stokowski, of the edited version of Moussorgsky's "Night on the Bare Mountain" which Stokowski prepared for the film. The other tracks are: Toccata and Fugue in D minor, presented in very florid orchestral dress by Camarata and the Kingsway Symphony Orchestra; Sorcerer's Apprentice, (Dukas) played by the London Philharmonic under Bernard Herrman; Dance of the Hours (Ponchielli) presented by Stanley Black and the London Festival Orchestra.

If you are looking for a souvenir disc of the film, the excellence of the Phase 4 recording adds to the musical attractions of this one. (H.A.T.)

★ ★ ★

JAMES BOND. Various orchestras and artists. United Artist stereo UAL 387 / 8. 2-record set $7.95.

Some time ago I reviewed an album of James Bond movie themes and found it a skull-numbing experience. Having survived it, I was confronted with this 2-record set which is great for pounding obstinate spies into submission. Some of the tracks taken in isolation (which I suppose is where they should be taken) are okay but four album sides are more than enough. If you are keen on persecution by high-fidelity, the sound quality is fine. There seems little point in listing the tracks. (L.D.S.)

★ ★ ★

THE BENNY GOODMAN STORY, Vol 1 & 2 MCA Enhanced for Stereo MAPS 1009, MAPS 1261 Astor release.

These two records are not sold together as an album but, as they are from the same film sound track of 'The Benny Goodman Story', I have reviewed them together. The original release dates back to the film some years ago; I presume that the re-release is to coincide with the recent Australian appearance of Goodman and his quintet. If you missed the live performance, you probably saw the ABC televised recording and enjoyed it as much as I did. Volume I has: Let's dance — Down South — Camp meeting — King Porter Stomp — It's Been so long — Roll 'em — Bugle Call Rag — Don't be that way — You turned the tables on me — Goody Goody — Slipped Disc — Stomping at the Savoy — One O'clock Jump.

Volume 2 carries on with: Memories of you — China Boy — Moon Glow — Avalon — And the Angels Sing — Jersey Bounce — Sometimes I'm happy — Shine — Sing Sing Sing. Among the personnel are some of the old greats such as Lionel Hampton, Gene Krupa, Harry James, and Teddy Wilson. These are two records I'll certainly keep a place for in my collection. (N.J.M.)

★ ★ ★

WOODY HERMAN, GOLDEN FAVOURITES. MCA MAPS 1070. Enhanced for Stereo. Astor release.

Most of the twelve tracks on this disc are tunes associated with Woody Herman's Orchestra of the thirties and forties and as such help to recapture some of the listening pleasure of those days. His signature tune, The Woodchopper's Ball, heads the list with other old favourites such as: The Golden Wedding — Yardbird Shuffle — Down Under — Blue Flame — Irresistible You — Chip's Boogie Woogie — Las Chiapanecas.

I presume the record has been reworked from original masters. If this is so, they have done an excellent job, although the "Stereo enhancement" gives more of a two channel effect than one usually likes. If you like the music of the era give this one an audition, I think you'll buy it. (N.J.M.)

★ ★ ★

TWO FACED BACH. Miguel Ramos at the Hammond organ, with Orchestra. Hispavox stereo HVL 34789. Festival.

Purists tend to throw up their hands in horror at the modernisation of old masters such as Bach, sometimes with justification. In fact, this disc serves to point up the very strong rhythmic base of much of his music and, as such, I found the record very enjoyable. The first item is "THE" Toccata and Fugue, followed by a group of short suites that are pleasantly familiar, even in an uptempo rendition such as this. The quality is superb. (N.J.M.)

★ ★ ★

TEQUILA COCKTAIL. Pepe Jaramillo and his Latin American Rhythm. Stereo Columbia SOEX 9781.

Pepe Jaramillo's very pleasant brand of piano playing backed by Latin American rhythm will be familiar to most buyers of discs of popular music. One of my favourite discs of this type is his "Latin Piano in Japan" which I invariably include in discs selected as background music for parties and other social occasions. This latest disc is going to complicate the matter of choice as it will be joining the short list of party discs, despite some deficiencies in sound quality, simply because it is such very pleasant listening.

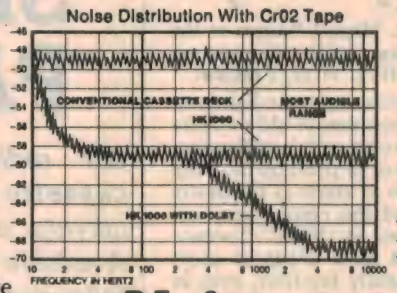
The titles are: Tequila Cocktail — Good Morning Starshine — I'll Never Fall in Love Again — The Shadow of Your Smile — My Way — The Fool on the Hill — Corazon Contento — Adios Amor — Loneliness — For Once in My Life — Yesterday I Heard the Rain — The Look of Love. Presumably the occasional distortion noticeable (which seems to affect only the piano) was caused by overloading somewhere in the recording chain. Despite this, the disc can be regarded as good buying at its $2.99 price. (H.A.T.)

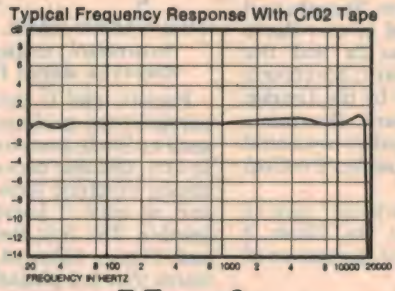
★ ★ ★

DREAMLAND FILM MELODIES. Nils Tibor at the Hammond organ. Stereo. Ace Of Clubs series 299 SCLA-7048.

By coincidence, I listened to this recording next in line to Tony Back's Hammond, reviewed elsewhere. The contrast could not be greater and, if my description of Tony Back's music put you off, then the chances are that Nils Tibor will be your choice, particularly at the Ace of Clubs price. To be sure, Nils Tibor stays with conventional Hammond voicing but, against a restrained

Never before has this little noise accompanied this much music.





If you're sophisticated enough to be reading this magazine, you're probably familiar with the two main characteristics of cassette decks: hiss and nonlinear frequency response.

Which should make you thoroughly unfamiliar with the performance capabilities of our new HK-1000. As the charts indicate, it behaves more like reel-to-reel than a cassette deck:

Noise.

Signal-to-noise (unweighted) is −58 dB with Dolby and −70 dB in the audible hiss level above 4,000 Hz. The frequency response curve is essentially flat from less than 30 to beyond 15 kHz, ±1.5 dB, with CrO_2 tape. (This curve is due largely to the way we drive our heads. Instead of the conventional constant *voltage* drive to the head, the HK-1000 is designed for constant *current* drive. Many studio model reel-to-reel decks are designed the same way.)

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The HK-1000 is also designed so you can use it often without endangering it. Plug-in printed circuit boards are used for simplicity and reliability of operation. Heads are easy to reach and clean. And the transport is the most reliable we've ever tested; it even closes with the sort of reassuring "thunk" you normally hear only by closing the doors of expensive hand-built cars.

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background of rhythm, he plays a dozen tuneful melodies that are currently as much a part of the electronic organ repetoire as were certain chestnuts in the theatre pipe era: Love Story — Fascination — A Man And A Woman — More — True Love — Moulin Rouge — Moon River — Lara's Theme — This Is My Song — Never On A Sunday — Goldfinger — Born Free.

Stereo is used to advantage and there are enough effects and gymnastic touches to show that Nils Tibor has plenty of ability to draw upon. If, as a popular organ enthusiast, you want music for dining and relaxing, this should fill the role very nicely. (W.N.W.)

★ ★ ★

HAMMOND DANCE PARTY 2. Tony Back. Interfusion Stereo (Festival) IFTL-34786.

If you should need any convincing, this new album will demonstrate the number of mod popular effects that can be extracted from the Hammond T-200 series organ, when teamed with a Sharma 5000 professional organ speaker and organist Tony Back. But be warned: Tony Back has no time for the usual organ imitative sound; his forte here is tempo, bass line, keyboard gynmastics, waa-waa effects and exploitation to the full of a rotating sound field loudspeaker system.

In line with the title, Tony Back locks most of it to percussion for dancing (mod style) but the title also suggests the alternative of "easy listening". If you do so listen, you'll find that the eleven tracks take in bits and pieces of 29 "golden melodies" such as: Born Free — Exodus — Aquarius — King Of The Road — Smile — Walk On — There'll Never Be Another You — Superstar — and so on.

If you like way-out Hammond, then Tony Back's your man. If you don't, then find something more relaxed to spend your money on! (W.N.W.)

★ ★ ★

JIM REEVES ON STAGE, With the Blue Boys. RCA stereo LSP-4062.

Generally, live performances on record are flat, in my opinion. But this album of Jim Reeves demonstrates his stage personality so well that you can't help enjoying it. One realises why he was so popular apart from the fact that he was a very fine country and western singer — he had such a fresh, lively personality.

Side one has Jim acting the goat quite a lot in between short stints of singing. On side two he sings more. Both sides are enjoyable. Sound quality is very good.

Some of the songs sung by Jim are: The Blizzard — Am I Losing You — Bimbo — Stand At Your Window — Danny Boy — Tennessee Waltz — Guess Things Happen That Way. (L.D.S.)

★ ★ ★

PIETRO PERO AND HIS ROMANTIC PIANO. Stereo, Astor SF 311. Three record boxed set.

The list of popular traditional melodies, evergreen light classics printed on the back of the box will attract a great many buyers, with such well-known tunes as Come Back to Sorrento — O Sole Mio — Cielito Liendo — La Paloma — Hymn to the Sun — Song of India — Kashmiri Song — Fantasie Impromptu — Liebestraum — One Fine Day — Blue Danube — Tales of the Vienna Woods — Claire de Lune — Moonlight Sonata — The Swan, Schubert's Serenade . . . and so on, 30 tracks in all.

If this kind of material appeals to you and the special price tempts you, a word of warning before you rush out to buy the set. Pietro Pero's playing style is what may be called "modern interpretation", with rhythm percussion in support. Many people who like their music played straight will find little to enjoy in this treatment of their favourite melodies. Those who favour the "swinging" treatment will not be disappointed. Sound and stereo are of normal modern standard. (H.A.T.)

★ ★ ★

MANDOLIN SPECTACULAR. Mandolin Ensemble. Stereo. Columbia (EMI) SOEX 9998.

This is another of the Japanese Toshiba recordings released here on EMI's $2.99 Columbia label. As usual, the recording is technically first class, and the Japanese performers display a high degree of competence with western style instruments. What is unusual here is the selection of titles. Japanese record producers have tended to stick closely to standards and evergreens, so one would expect to find the well known Mandolin titles (O Sole Mio, Come Back to Sorrento, etc.) Instead one finds the following little known titles: Mandolinese Congress (Bracco) — Nell' Oasi (Eliseo Muiti) — Suite Marinaresca (Amadeo Amedei) — Gli Orazii ed i Carizir (D. Cimaroso) — Mazurka — Concerto (C. Munier) — Grenade Morisque (Matias M. Garcia) — Dante e Beatrice (C. Grazioni — Walter).

Unfamiliar music but tuneful enough to appeal at first hearing and having the kind of qualities which should have lasting appeal. (H.A.T.)

★ ★ ★

WHEN IRISH EYES ARE SMILING. Bing Crosby. MCA stereo DL 78262. (Astor Gold Star series).

A NOSTALGIC HOUR OF BING CROSBY. MCA Gold stereo MAPS 6328.

A wave of nostalgia is sweeping the United States and Australia is getting some of the backwash. (Sorry about that.) But after all, we used to like Bing Crosby too. Why not go out and buy one of these albums as a memento? They are a lot of fun. The first disc is devoted to tunes with an Irish flavour while the second covers everything from "Blue Hawaii", "Mississippi Mud" and "White Christmas".

Sound quality is variable from good to lousy but most buyers won't worry about that as long as they can follow the words. The same can be said for the "reprocessed" stereo — it is of no consequence. The second disc has more tracks but the first is more listenable. (L.D.S.)

★ ★ ★

THE LITTLE ANGELS. Philips Stereo 6308 137.

On their recent Australian tour, the National Folk Ballet Of Korea charmed audiences with their artistry in song and dance and this Philips release is a pleasing souvenir of their visit. The sound quality varies somewhat. Possibly the record is a mixture of studio and live performance, and the presence of audience applause on some tracks could be a clue to this.

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The TD8S is undoubtedly the highest quality 8 track cartridge player available. But why not hear the superior sound of this brilliant machine for yourself at your nearest retailer of sound equipment, because as we said before, the TD8S literally speaks for itself.

Technical Data
Number of tracks: 8 (4 stereo channels); Tape Speed: 3¾ in. per sec. (9.6 cm/sec); Programme Selector: Automatic and manual; Tape Head: Nortronics 4 track with hyperbolic face; Pre-amp Output: 3 stage 750 mv (nominal) 1 Kc Standard Reference Level Tape; Track Playback Sequence: 1 and 5, 2 and 6, 3 and 7, 4 and 8 and infinite repeat; Wow/Flutter: Less than 0.3% total; Frequency Response: Better than 50–10,000 Hz; Power Supply: 210–250 volts, 50 Cycle AC; Dimensions: Cabinet: 261 mm x 206 mm x 99 mm; Net Weight: 5¾ lbs.; Cartridge Dimensions: This unit will accept standard 8 track cartridges measuring 139 mm x 101 mm x 22.5 mm.

BSR (A'asia) Pty. Ltd. Southern Section
Industrial Estate St. Marys New South Wales
Telephone 623.0375 and 623.0376

Wholesale Distributors

Goldring (N.S.W.) Pty. Ltd.,
26-28 Ricketty St., **Mascot.** 2020 Phone– 669 6088

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Unit 5, 83-85 Wollongong St., **Fyshwick.** 2069
Phone–95 8248

Goldring (W.A.) Pty. Ltd.,
32 Northwood St., **Leederville.** 6007 Phone–84988

BSR McDONALD
TD8S

BSR 118R2

VARIETY FARE

There is a mixture of Western hits such as: Mother of mine — Get me to the church on time — Dominique — Amazing Grace, and other well-known show tunes together with a number of traditional Korean songs. The Little Angels are obviously well trained and their fresh young voices are a delight to listen to. (N.J.M.)

★ ★ ★

LOUIS ARMSTRONG'S HELLO DOLLY. MCA Stereo KS 3364. Astor release.

The showmanship of the late Louis Armstrong shines through on every track of this enjoyable record. Such all-time favourites as: Hello Dolly — It's been a long long time — A kiss to build a dream on — Hey, look me over — Moon River — Be my life's companion — Blueberry Hill — Jeepers, Creepers — A lot of lovin' to do — Someday — I still get jealous — You are woman, I am man.

The overall quality is excellent. (N.J.M.)

Jazz and Rock . . .

NEWPORT IN NEW YORK '72. The Jam Sessions, Vol 1. Atlantic stereo SD 1012.

Two long performances, "Jumpin' at the Woodside" of 21 and a half minutes and "Lo-Slo Blues" of 22 and a half minutes make up an album of jazz from last year's New York Jazz Festival.

Those on stage were Cat Anderson and Jimmy Owens on trumpets (Owens playing a fluegelhorn by the sound of it), Charles McPherson on alto saxophone, Buddy Tate, tenor sax, Milt Buckner organ, Roland Hanne piano, Charlie Mingus bass and Alan Dawson drums.

I'm always suspicious of jazz tracks which try to stay funky for a whole LP side. No need. Each of the eight band members maintains a surprising degree of concentration.

"Jumpin' " is tight, clean and exciting, everything that you would expect an up-tempo improvisation to be.

The "Blues" predictably has the best and worst of the album aboard. Cat Anderson does some crowd pleasing with a stratospheric chorus. Mingus eclipses him with an extraordinary bass solo. The track then settles down and Mingus comes back with a solo of extraordinary charm. (G.W.)

★ ★ ★

FLANAGAN'S SHENANIGANS. Pearce-Pickering Ragtime Five plus guests. Swaggie mono S1309.

Recorded in the Hobart studios of the ABC, this veteran group continues to play easy-going, unfussed jazz.

Trumpet player Bruce Dodgshun is new to records. His playing fattens "The Jazz Parade", "Shut Up Boona Baby", "I've Got a Feeling I'm Falling" and "Pennies from Heaven".

The group is basically a piano and clarinet contrapuntal outfit but it is able to turn on exceptional colourations to meet the needs of a guest. Singer Kay Stavely, for instance, brought about a metaphorphosis in Pickering and had him playing big, melodic tenor saxophone in the Chu Berry style on "Carelessly".

"I'll never Be the Same" has similar playing although the guitar and voice intro seems miffed.

Ian Pearce at piano is the strength of every performance. The lyricism of Pearce and Pickering has resulted in an LP of jazz of great spirit.

Michael Colrain is the drummer on most tracks. Bass playing is shared by Ron Roberts, Des Conrades and Barry Johnson. Ken Chaffey is on guitar and banjo. (G.W.)

★ ★ ★

THE LONDON CONCERT. Duke Ellington. United Artists stereo UAL 273 / 4.

Ellington has managed to continue to provide exciting jazz with a band which, in October, 1971, had undergone considerable personnel changes.

The record was made in London, just a year after the 70th birthday concert album. It is a fine sequel to that set. None of the tunes are repeated. Using new saxophone players Norris Turney and Harold Minerve, Ellington launches into a new suite "Togo Brava, Brava Togo" dedicated to a west Africa State. It too, is typical of Ellington's major works, suggesting a life cycle from birth to manhood. (G.W.)

★ ★ ★

FILTHY. Papa John Creach. Grunt stereo FTR 1009-G.

Creach plays hot violin in the Stephane Grappely style. He even sounds good amongst the dreary accompaniment on this record. Imagine a teenybopper chorus of females, a rock band, and a dubbed-in brass and horn section!

Creach has a good blues voice which comes over well on a number of tracks.

"Far Out" shows his skill with the violin. There's disconcerting use made of a Jew's Harp on many of the tracks. I consider that this is a most unsuitable jazz or rock instrument. Another blues singer of merit, Big Joe Turner, sings on "Give Me an Hour in Your Garden". He has to suffer the drummer on the session who plays every number loud and predictably. (G.W.)

★ ★ ★

TOMMY, JIMMY AND EDDIE, 1928-29. Swaggie mono S1299.

These records were made after the Dorsey brothers, Tommy and Jimmy, had left Paul Whiteman to form their own band. Guitarist Eddie Lang was present on each of the 17 tracks on the disc. Eddie either solos or gives that particular Lang lift to the rhythm section.

The LP opens with Tommy Dorsey on trumpet playing in duet with the great jazz trumpeter Leon McConville on "Bugle Call Rag". Jimmy Dorsey provided the soaring clarinet and Arthur Shutt was on piano. It is a magnificent track, summoning the listener to sit down and enjoy the entire disc.

Tommy, Jimmy and Eddie used their names to head the bands, with the exception of the two earliest cuts, made with the clarinet player Boyd Senter. Senter was more a caricature of a jazz player than a stylist in his own right.

Mildren Bailey made her recording debut on the track "What Kind o' Man is You". The terrible lyric is the only concession to commercialism on the whole album.

Some of these tracks were around on re-issue in the forties. It's good to hear them again and appreciate the hard biting trumpet style that Tommy had in those days — quite the opposite of his later sentimental trombone playing. (G.W.)

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PRODUCT REVIEWS AND RELEASES

High performance player from Haco

Record playing equipment seems to be under constant improvement and refinement in performance. An excellent example of this trend is a new direct drive record player from Haco, the Technics SL-1200.

An eye-catching product, the new player combines a 2-speed turntable having very ambitious specifications with an arm intended for use with any of the currently available high quality cartridges. It is a player which would command respect in any hi-fi listening situation.

The "Technics" 1200 is mounted in a metal and plastic housing, meant to be free-standing rather than mounted on a wooden plinth in the usual manner. The main base is finished in a metallic grey lacquer, with a smoke coloured acrylic lift-up lid fitted with friction hinges to keep it up when required.

The whole unit rests on four pillar type shock absorbent feet, which could be removed to set the unit into a recess cut into a cabinet. The overall dimensions, cover included, are 450mm wide, 370mm deep and 162mm high.

The die-cast aluminium turntable has a strobe pattern cast into the sloping rim. This is illuminated by a neon lamp in a small metal pillar on the left hand corner of the base, adjacent to the speed selection switch and vernier speed adjustment.

This is intended for use with two separate speed control knobs, one for 33 and the other for 45rpm. The speed can be adjusted "spot on" or set deliberately high or low where this is required for a special reason.

As mentioned in the introduction, the SL-1200 employs the direct drive principle, the motor being integral with the turntable and operating at the same spindle speed. The idea was exploited in some early 78rpm turntables and involved a multi-pole synchronous motor almost as large as the turntable itself. These motors were generally plagued by hum fields, however, and did not lend themselves to multi-speed applications.

Electronic circuitry solves these problems in the new Technics turntable, making possible a much more compact drive assembly, with two-step speed change, vernier speed adjustment and very precise regulation at any setting.

The direct drive principle used has the great advantage that it avoids the generation of high frequency vibration components normally produced by motor unbalance, gearing, idler wheels or belts, which often contribute their own unwanted song to the recital.

The electronic drive and speed control circuitry for the brushless DC motor is mounted on a printed wiring board fitted with plug-in connectors. We could not inspect the motor in detail but we presume it is fitted with a tachometer or similar velocity feedback device to ensure accurate control. The power supply transformer is well isolated, both mechanically and electrically from any sensitive area, particularly the pickup's arc of travel.

The tubular arm of light alloy carries a lightweight offset headshell, fitted with a standard EIA screw collar attachment. The playing weight adjustment is provided by a counterweight moved by a smooth rack and pinion mechanism.

The adjustment knob carries a collar graduated in grams, so mounted that as you turn the knob back to reach balance, after fitting the cartridge, the collar comes to a stop, reading zero. As you turn the knob back from this balance point you get a direct reading of playing weight on the scale. There would be a change in accuracy of the scale, depending on its position on the arm, but this should be of little consequence.

Anti-skating compensation is taken care of with a small, graduated knob at the base of the arm. The makers claim a noise and rumble figure better than —60dB — which we found to be conservative. In fact we could not measure any noise component attributable to the mechanics of the player when using the silent run-out grooves on a CBS test record.

We were not in a position to measure wow and flutter directly but observations of sine wave signals from the test record, STR 100, showed a remarkably steady pattern on an oscilloscope.

At a retail price of approximately $300 it is a player for the well-lined pocket but the performance is of a correspondingly high standard. And with really only one moving part in the turntable, reliability and wear should present no problems.

Technics Turntables are distributed in Australia by Haco Distributing Agencies Pty Ltd, at 57 Anzac Parade, Kensington, 2033. (N.J.M.)

McMURDO: Prototype push-button switch kit

A comprehensive isostat kit containing all the hardware required to develop prototype push-button switch banks is now available.

Contents of each kit includes; 2,4,6 and 8 change-over modules, together with AC modules, springs, circlips, brackets and a range of illuminated and plain buttons in a variety of styles. A demonstration switch bank and complete instructions for assembly are included. McMurdo (Australia) Pty Limited, PO Box 321, Clayton, VICTORIA, 3168.

Philips SM130 'Sound Module': large sound from a small space

After a decade or more of stereo record reproduction, most of us have become accustomed to living with two rectangular loud speaker enclosures in the lounge room. With the advent of 4-channel sound the space question has cropped up again, but the new SM130 "Sound Module" from Philips could well solve a lot of problems in this area.

Bearing little resemblance to the usual concept of a loudspeaker enclosure, the "Sound Module" measures 60cm x 75cm; but it is only 8cm thick, a fact that greatly simplifies placement. They may be hung on the wall, or used as a fire screen or incorporated as part of a room divider.

To merge with differing decor arrangements, a choice of front panel fabrics is available in abstract patterns, as well as a choice of wood finishes for the frame.

The back is sealed against tampering (a most unsporting move!) but, through the rear grille cloth, one can make out the shape of a large ceramic magnet at the centre of the sound panel and another smaller magnet up in one corner, presumably providing the tweeter function.

The sound panel, ostensibly of rigid polystyrene foam, replaces the normal paper cone of a more conventional loudspeaker and is driven by the two voice coils. These share the signal by means of a simple crossover network.

With over a quarter of a square metre of radiating surface, the panel has an area much greater than any normal loudspeaker and consequently can move a greater amount of air for a given movement of the diaphragm. At the same time, of course, it has to do this without the assistance of a conventional enclosure.

The large piston area, plus the large high-flux magnet assembly, would make one expect high acoustic efficiency and this was borne out in our comparisons with other loudspeakers of well known performance. The Sound Modules are certainly modest in their drive power requirements.

Laboratory tests revealed a system with a somewhat "forward" sound, indicating strength in the middle register. A reasonable amount of bass boost is necessary to even out the response. The main diaphragm resonance occurs at 65Hz; below this the output falls off rapidly, emphasizing the need for bass boost.

On average program material the system produces clean and pleasant sound but, on complex musical passages, there is some evidence of intermodulation.

The mount-anywhere slimness of the "Sound Module" would facilitate its use, not only in awkward domestic situations but in shops, restaurants etc where an ordinary enclosure would look out of place.

At $149.00 each, they are not exactly an economy model, but their power handling rating of 30W, their acoustic efficiency and ease of placement should recommend their use in a wide range of situations. They are available from Philips sales departments or from hi-fi outlets.

Two new op amps from Philips Elcoma

Two new operational amplifiers, the TCA490 and the TCA520B, have been released by the Elcoma Division of Philips Industries Ltd.

The TCA490 is a low noise, dual operational amplifier with a wide application range. An output noise voltage amounting to only a fraction of a millivolt makes the TCA490 suitable for applications ranging from industrial control systems to low distortion stereo preamplifiers.

Available with specified output noise voltage limits of 125uV, 250uV, or 400uV rms, the dual op amp has a typical voltage gain of 15,000 and a typical common mode rejection ratio of 100dB.

Salient features of the TCA520B are its ability to operate with any supply voltage from 2V to 20V and to deliver output voltages within 0.1V of the supply voltage. Typical slewing rate is 50V / us. A principal application foreseen for the new op amp is as a TTL-compatible comparator. Encapsulation of the TCA530B is 8-pin DIL.

For further information contact Elcoma at Mars Road, Lane Cove, NSW 2066.

RH 521: An amplifier continental style

There is no dearth of high quality amplifiers on the market these days but the RH 521, a new release from Philips, stands out with its crisp, continental styling. It is well worth consideration by anyone planning to up-date their hi-fi system in the immediate future.

The front panel is styled in brushed aluminium, while the case has a satin finished walnut top and leather-grain vinyl end panels. The top two-thirds of the panel is occupied by two output meters at the left-hand end and a large volume control knob at the right.

Below this level, slightly recessed, are four slider controls for balance, bass, presence and treble. Two small pilot lights, also in the recess, indicate power on and mono-stereo respectively.

Twelve rocker type switches, with individual and inter-locking mechanisms as necessary, cover input selection, mode, speaker selection and power. The contour or loudness function and the scratch and rumble filter are controlled by two alloy knobs, sharing the lower line of the panel.

plus and minus 6dB variation around 2kHz. This latter control can produce quite a clarifying effect on speech, either recorded or 'live', where clarity is the prime requirement.

Rumble and scratch filtering is provided with three options: rumble plus scratch, rumble alone, or scratch alone. The attenuation slope in each case is 12dB per octave, with the 3dB points at 80Hz and 7kHz respectively.

The contour or loudness control provides three levels of bass and treble boost at low volume settings, with a maximum of 20dB at 50Hz and 9dB at 10kHz.

On test, the RH 521 met or exceeded most of the manufacturers specifications within normal instrumental tolerances. Output power was measured at 30.25 watts per

channel before clipping. After a long run at full sine wave power the output before clipping did fall to 27.5 watts, as a result of slight bias shift due to heating, but as continuous sine wave operation is most unlikely in practice, this is an academic point.

Facilities for microphone and headphone connection are conveniently to hand via two DIN sockets, concealed under a hinged flap at the left hand end of the front panel. They are concealed almost too well, in the sense that the facility could easily be overlooked!

Sharing the back panel with the massive heatsinks are five DIN sockets for pickup, recorder, tuner, auxiliary and monitor. In addition there are four DIN type loudspeaker sockets for front and rear loudspeakers in the "Stereo 4" mode or for main and extension loudspeakers in normal stereo operation. A mains voltage selector rounds off the back panel compliment.

For the "Stereo 4" mode, the rear loudspeakers are connected substantially in series to provide an inexpensive form of simulated quadraphonic reproduction.

Removing the timber top reveals a well packed interior but service accessibility should present no special problems. Access to the underside of the pre-amp board is via a perforated metal bottom cover. Other boards are supplied with sufficient lead length to allow removal from the chassis for check or repair.

The power amplifier follows normal quasi-complementary symmetry practice, with overload protection afforded by an SCR 'crow-bar' that removes the drive to the output stages under fault conditions.

With the wide range of controls on this amplifier, the user can tailor the response curve to suit almost any requirement. The bass control gives plus and minus 14dB while the treble control yields plus 14 and minus 16dB. The presence control gives a

Frequency response is quoted as being plus 0.5, minus 1dB from 20Hz to 20kHz; we found it to be down 1½ dB at 20 Hz.

Distortion at 20W per channel was 0.15pc, compared to the quoted figure of 0.1pc. Signal-to-noise was good at 80dB, with open circuit input, although the claimed figure is 90dB. Other parameters, such as cross talk, were found to match or better the published figures.

Square wave response was virtually "text-book", with no sign of ringing. Likewise, capacitive loads caused no embarrassment to the amplifier. Stability under a variety of load conditions would appear to be one of its strong points.

A listening test with a variety of records bore out the test-bench results, with an effortless, high-quality performance. With the pickup lifted from the record at normal room level one had to get within an inch or two from the loudspeaker to detect any hiss or hum.

With the range of control facilities provided, the RH 521 should find ready appeal amongst the discriminating buyers with $309 in their pocket. This and other products in the Philips hi-fi range are available from Philips' sales departments in each state or from selected retailers. (N.J.M.)

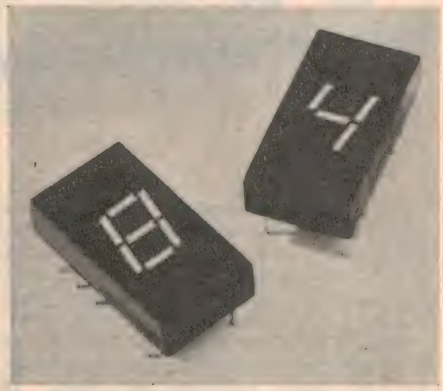
NEW PRODUCTS

Low cost 7-seg LED indicators

At only $2.36 each in quantities of 1000, these new LED numeric indicators are ideal for commercial applications.

Now at prices equal to, or less than comparable gas-discharge display tubes and many LED displays, a new series of Hewlett-Packard solid-state numeric indicators is especially suited for commercial applications. With uniformly lit, diffused segments, the characters appear sharp and clean, and thus are pleasing to the eye. Calculators, television receivers, radios and digital clocks are among many uses to which they can be put.

Two 0.3inch high, single-digit units are announced. The Model 5082-7730 contains a left-hand decimal point; the Model 5082-7731 has a right-hand decimal point. Both have the same pin configuration and same package outline as the MAN-1, Data-Lit 10, and similar Led displays, although the character height is larger. The use of the standard DIP package allows for socket or printed circuit board mounting. Individual



digits can be close packed on 0.4 inch centres, but the larger character height allows other spacings where desired.

Electrically, the displays are IC compatible. Forward voltage per segment or decimal point is 1.6 volts. Luminous intensity is 250 microcandelas per segment typically. Operating current is typically 10mA per segment when strobed.

Both displays, built on rugged lead frames, are arrays of eight discrete diodes optically "stretched" to a uniformly lighted diffused bar. Only one LED per segment is required because of a unique funnel-shaped "light pipe" that lights a bar 5 times the length of the LED chip.

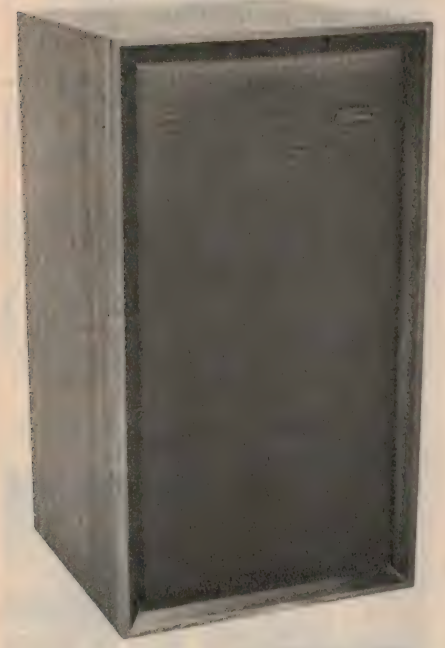
To improve contrast, the entire front surface of the display, except for the emitting areas, is finished in a uniform flat black. An additional filter may be used to further lower ambient reflections and improve contrast.

Pricing structure is based on quantity as follows: 1-99, $3.16 ea; 100-999, $2.60 ea; 1000, $2.36 ea.

For further information, contact Hewlett-Packard Australia Pty Ltd, Marcom Department, 22-26 Weir Street, Glen Iris, Victoria 3146. Phone 20 1371.

A compact loudspeaker system from Goodmans

If you are in the market for a compact loudspeaker system capable of a very pleasing performance, the Goodmans "Minister" would be worthy of your attention. It combines Australian cabinet work with a pair of imported drivers — one woofer and a dome tweeter.



Tastefully finished, the Goodmans Minister measures 48.2cm x 26.6cm x 25.4cm. It is available in either teak or walnut veneer and a matching wooden surround encloses the recessed and padded grille cloth. The veneer finish is carried right around the outside to allow the cabinet to be positioned either vertically or horizontally, as required.

Internally, a 20cm (approx) diameter bass drive unit (a nominal 8-inch type) operates in conjunction with a 2.54cm dome tweeter. The bass driver is of quite modest appearance but the specially treated cone and roll surround indicates that it has been specially produced for the job in hand.

Apart from the cone design, the characteristics of the system at the bass end would be influenced by a vent tune 16cm long and 5cm diameter and by a generous fill of light bonded fibre. Presence of the fibre would undoubtedly modify the resonance of the enclosure so that its behaviour would probably fall midway between that of a fully sealed or fully vented system.

Both screw terminals and a DIN socket are provided on the back panel and the connecting lead supplied has a din DIN plug on one end and spade lugs on the other. Since the lead can be used either way with the loudspeakers, the user can present either lugs or the connector to the amplifier.

Tests with an audio signal revealed a very smooth performance over the whole audible range, with a just perceptible peak in response around 65Hz. With the amplifier tone controls set for flat response, the bass fell off rapidly below this but, in practice, overall balance would be restored with a little bass boost.

When we played a variety of records through the "Minister," we were quite impressed with the overall performance. The response is not as "forward" as some systems we have heard but this is offered more as a comment than a criticism.

Acoustic efficiency of the system is fairly low and Goodmans themselves state that a ten watt per channel amplifier is necessary to provide adequate sound levels for domestic use. At the same time a power rating of 20 watts would indicate that they should not be driven beyond the requirements of a normal listening situation.

At a retail price of $84 each, the "Minister' represents good listening and good value if you are after a compact speaker system. They are available from selected hi-fi retailers in all states. (N.J.M.)

Updating for colour television

The Institution of Radio and Electronics Engineers and the University of New South Wales have jointly organised a Workshop on Colour Television to be held at the University from 13-17th August. The first meeting of the workshop is to be opened by the Minister for the Media, Senator Doug McClelland.

The aim of the workshop is to bring together those who will be associated with the Australian change from monochrome to colour TV, to discuss common problems, and also to make available some of the recent experience of overseas television authorities. To the latter end, six prominent colour television experts from overseas will be in attendance: C. E. Anderson from Ampex, C. R. Longman and F. G. Parker from the BBC, Joe Roizen from IVC, C. Siocos from CBC, and H. Thielcke from NDR.

Abstracts of the papers to be used to start the discussions will be made available to delegates prior to the meetings. Delegates are expected to be senior engineers from both commercial and government broadcasting organisations. Registration fee is $2.

Further information from the General Secretary of the IREE, or from Dr J. Hiller, University of NSW.

NEW PRODUCTS

New speaker kits from Plessey Rola

Plessey Rola has introduced two new high fidelity cabinets in kit form for enthusiasts interested in both top performance and keen value.

Designated CK1 and CK2, the kits have been designed for optimum performance with the Plessey C80 woofer and two C3GX tweeters in the CK1, and the recently released C100 woofer and X30 tweeter combination in the CK2.

Extremely simple to assemble and finish in the required timber toning, the Plessey do-it-yourself kits represent a considerable saving over fully finished enclosures of similar performance. Anyone who can use a screwdriver could complete two cabinets for a stereo system in just one afternoon's work. The finished product is a high quality,

high performance unit with a most attractive appearance.

The CK1 kit makes up a 1.8 cu ft cabinet. With the recommended Plessey speakers, frequency response is 44 Hz to 20 kHz and power handling capacity 20 watts RMS. A 2.5 cu ft cabinet is produced from the CK2 kit. Fitted with the recommended speakers this system has a frequency response from 40 Hz to 30 kHz and 20 watts RMS power handling.

Kits are available from Plessey Rola distributors and other leading hi-fi dealers. Further information may be obtained from Plessey Rola Pty Limited, The Boulevard, Richmond, Victoria.

Directory error

Butterworths & Co (Aust) Ltd advise that due to an oversight their name and address has been omitted from the 1973 Sydney telephone directory. The company may be contacted at: 586 Pacific Highway, Chatswood, NSW. Telephone 412 3444.

NEW PRODUCTS

IC breadboard from McMurdo facilitates IC systems design

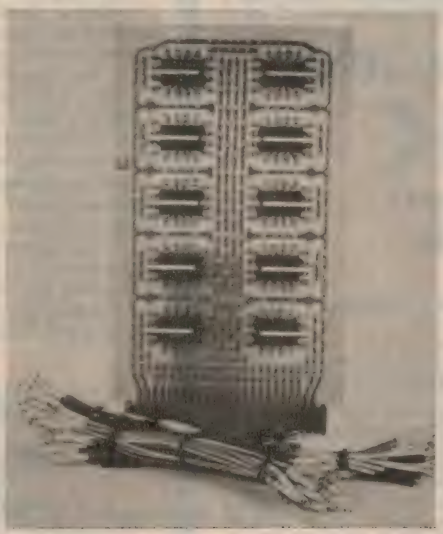
A new IC breadboard to assist in the design and production of electronic equipment has been developed by McMurdo. It provides a rapid and economic means of interconnecting integrated circuits, thus facilitating the speedy checking of designs and also providing a means of quickly assembling temporary test units.

Designated P/N 2150-99-90, the unit comes complete with 10 IC sockets, 75 mixed colour jumper leads, and a 24-contact Redline edge connector.

All kinds of integrated circuits, including flat pack, TO5, and dual-in-line are catered for, and in addition, provision is made for including special circuits made up from discrete components. Interconnections are made with ready-made plug-in wire links, which enable units to be wired up many times faster than by conventional means. The IC sockets, which are 16 contact 0.300 inch row types, are fitted with an unloading key.

Price of the complete breadboard kit, including 75 leads and the edge connector, is $35 plus sales tax.

For further information contact McMurdo (Australia) Pty Ltd, 242 Blaxland Rd, Ryde, NSW 2112. Telephone 807 1944. Also at 17-21 Carinish Rd, Clayton, Victoria 3168. Telephone 544 3033.



Wide angle deflection and large screen Trinitron systems from Sony

The Sony Corporation of Japan has announced the technical development of a super-wide-angle deflection Trinitron colour TV tube, together with a new wide screen Trinitron system.

Sony first developed the epoch making Trinitron colour TV receiver in 1968 and, since then, has produced and shipped out more than 3,700,000 sets. Then in April 1972 they brought out an improved wider-angle Trinitron tube with a deflection angle of 114 degrees and vastly improved picture quality.

In the meantime, Trinitron colour TV sets incorporating new advanced techniques have been continuously developed, and now Sony has succeeded in producing receivers for the Japanese market incorporating an 18-inch 120 degree Trinitron and a 20-inch 122 degree Trinitron.

The Trinitron system has several unique features. These include: a single gun producing three in-line electron beams, narrow-necked picture tube, aperture grille with continuous vertical slits, and a large electron lens. Also, the closer the electron gun is to the phosphor screen, the better the colour picture resolution obtained. As a result the colour resolution of the new wide-angle tubes is very good.

Sony has incorporated a GCS (Gate Controlled Switch semiconductor device) in the horizontal deflection circuit of the new sets, and developed a specially designed lightweight deflection yoke. This has produced a super thin colour TV set, with a depth of only 35.2cm in the 18 inch 120 degree wide-angle tube and 37.0cm in the 20 inch 122 degree tube.

The new wide screen Trinitron colour tube developed by Sony measures 27 inches diagonally and incorporates the 114 degree wide-angle deflection system.

A high resolution colour picture is obtained because the special electron lens system reduces the beam spot magnification, and the number of picture elements is increased as a result of the large screen.

STC-Cannon Components

As from 1st July, 1973, the Components Division of Standard Telephones and Cables Pty Ltd and Cannon Electric (Aust) Pty Ltd have been amalgamated to form a new company under the name of STC-Cannon Components Pty Ltd.

All orders on the Components Division of STC will now be supplied by STC-Cannon Components and all future correspondence and orders should be addressed to STC-Cannon Components Pty Ltd, Moorebank Avenue, Liverpool, NSW 2170, tel 602 0333, or to 248 Wickham Road, Moorabbin, Vic 3189, tel 95 1566.

EXTRA-DYNAMIC

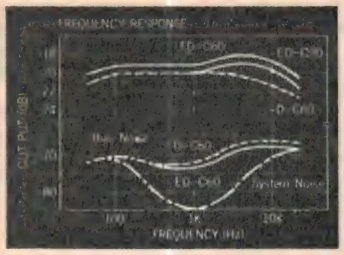
THE AUDIOPHILE TAPE

NEW ASTOUNDING MATERIAL

TDK "MAGNETITE"

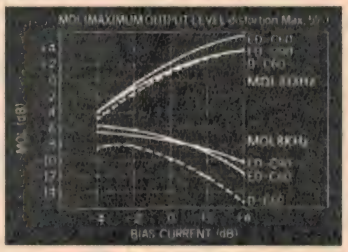
• THE CASSETTE DESIGNED EXPRESSLY FOR PURE SOUND

Performance data show ED superiority, but Your Ears also tell the difference of ED Cassettes. There is linearity of frequency response from low to high frequency range. No need for Cro selector to correct for excessive high response and low frequency drop off. Any good recorder can now give balanced high fidelity recordings.



• THE IDEAL CASSETTE FOR NORMAL BIAS

The bias required is normal, that is the target for any magnetic tape. ED is the dynamic tape which suits almost every cassette recorder. No necessity for special bias settings. The superior performance of ED is achieved by the highest and even the lowest priced recorders.



• THE MATERIAL IS PURE-BLACK MAGNETITE

TDK research has brought magnetite to cassettes for the first time. TDK Electronics Co, Ltd is a pioneer in the field of electromagnetics, and has now achieved the stabilisation of Magnetite material for recording tapes for the first time.

Convoy International Pty Ltd

Corner Plunkett & Maclean Sts, Woolloomooloo
2011. SYDNEY. Telephone (02) 357-2444

FERGUSON

Manufacturers of: Electrical/electronic equipment, wound components and lighting control equipment.

VERSATILE RANGE OF LOW HEIGHT POWER TRANSFORMERS

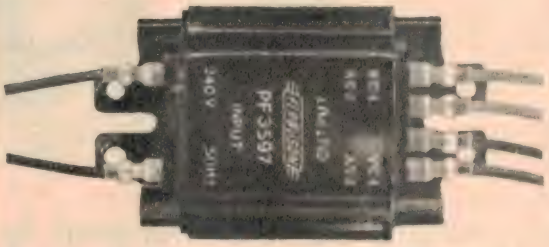
These transformers comply with the requirements of Australian Standard C126, where applicable, with respect to insulation and winding construction.

If forming part of a prescribed item, to be submitted to an Electricity Authority, it is essential to ensure proper earthing facilities, adequate ventilation and segregation of primary and secondary leads.

All the transformers in this range are suitable for connecting to 240 Volts 50 Hz., single phase supply and are nominally rated at 20VA. Dimensionally they are identical, with height limited to 1½", width 2-3/8", length 4-5/16" and mounting centres 23/32" by 3-27/32 inches.

Each tranformer is provided with two identical secondary windings which permit series or parallel operation, are fitted with round pin terminations and are supplied with a set of six leads with shrouded recepticals.

The tabulation sets out against type numbers the nominal rating and the voltage obtained for various loads when the windings are connected in series, 240 Volts being applied to the primary winding:—



TYPE No.	NOMINAL RATING	VOLTS OUTPUT @: 5VA	10VA	15VA	20VA	25VA
PF3596	6V @ 10VA	13.0	12.6	12.0	11.5	11.0
	6V @ 10VA	(0.39)	(0.80)	(1.25)	(1.74)	(2.28)
PF3597	7½V @ 10VA	16.6	16.0	15.4	14.7	14.1
	7½V @ 10VA	(0.30)	(0.63)	(0.98)	(1.36)	(1.77)
PF3598	9V @ 10VA	19.8	19.2	18.0	17.6	16.7
	9V @ 10VA	(0.25	(0.52)	(0.84)	(1.14)	(1.50)
PF3599	12V @ 10VA	26.4	25.6	24.6	23.5	22.4
	12V @ 10VA	(0.19)	(0.39)	(0.61)	(0.85)	(1.12)
PF3600	15V @ 10VA	33.0	32.0	30.0	28.9	28.0
	15V @ 10VA	(0.15)	(0.31)	(0.50)	(0.69)	(0.89)
PF3601	20V @ 10VA	43.5	42.2	40.7	39.1	37.3
	20V @ 10VA	(0.13)	(0.24)	(0.37)	(0.51)	(0.67)
PF3602	25V @ 10VA	54.0	52.2	50.4	48.4	46.2
	25V @ 10VA	(0.09)	(0.19)	(0.30)	(0.41)	(0.54)

Approximate current in Amps shown in brackets.

FERGUSON TRANSFORMERS PTY. LTD.
HEAD OFFICE: 331 High St., Chatswood, 2067
Telephone: 40-0261

AGENTS

TAS.
Associated Agencies Pty Ltd
25 Barrack St., Hobart, Tas, 7000
Phone: 2-1843.

A.C.T.
A.C.T.I.E.C. Pty Ltd
21 Patterson Pde.,
Queanbeyan, N.S.W., 2620
Phone: 97-3579

QLD.
Keith Perry & Co Pty Ltd
Waterlook St., Newstead, Qld, 4006
Phone: 51-5461

W.A.
H.J. McQuillan Pty Ltd
57 Division St.,
Welshpool, W.A., 6106
Phone: 68-7111

S.A.
K. Farmer Sales Pty Ltd
141 Gilles St.,
Adelaide, S.A., 5000
Phone: 23-4702

VIC.
Ferguson Transformers Pty Ltd
181-183 Hawke St.,
West Melbourne, Vic., 3003
Phone: 329-7437

AWA launches new radiotelephone

Amalgamated Wireless (Australasia) has released a new series of smaller and more advanced two-way radiotelephones for mobile use, the "Fleetmaster Carphone" series. Included are units for both the VHF and UHF bands.

The "Fleetmaster" range employs state-of-the-art circuit and design techniques to provide mobile units and base stations to suit all likely user requirements. Mobile units are available for all VHF and UHF bands, and in power ratings of 10 and 25 watts. The matching base station equipment is available in 25 and 50 watt ratings.

A special feature of the "Fleetmaster" receiver is the extended range switch, which may be used for improved fringe area operation. The receiver is so small that it may be mounted directly in the dashboard space normally provided for a standard car radio. Extruded aluminium sections are used to provide extreme ruggedness and stability. Push-pull controls are used for on off, muting and channel selection, for convenience and foolproof operation. The channel indicator is illuminated to facilitate convenient night operation in taxis and similar applications where multiple channel operation may be used.

The equipment includes "Sel-call" and "Quiet-line" facilities to allow individual calling of up to 700 mobiles on one system.

The new Fleetmaster range will be produced concurrently with the 25M and 15M Carphones that have been standard equipment with many users over recent years. Both the Fleetmaster and the older Carphones are backed by AWA's solidly based engineering expertise and quality control.

The Engineering Products Crystal Section has also announced the development of a miniature monolithic crystal filter, type 3Q62099, for 30kHz and 25kHz channel equipment. The filter has a centre frequency of 10.7MHz, 6dB bandwidth of +7.5kHz min, and 80dB bandwidth of +20kHz maximum; insertion loss is 4dB, and input output impedance 3.3k. Enquiries for the filter may be sent to PO Box 96, North Ryde.

AVE moves: in two directions

Australian Video Engineering (AVE) became a wholly Australian-owned company on the 1st April, 1973, and is no longer connected with the Philips Group of Companies.

In addition to established agency products such as International Video Corporation, Ikegami Tsushinki Co Ltd, Grass Valley Group, Dynasciences, and Electronic Engineering Company of California, AVE is extending its product range with such manufacturers as Audiotronics Corporation of California, makers of ruggedised audio equipment for education, and Tamron CCTV Lenses.

Several new items of equipment are now being marketed by AVE. These include a low cost PAL colour camera (the IVC-91), 3M video tape, and a mass memory recorder (the MMR-1) capable of recording up to 85 million bits on one reel of tape. A new PAL colour cartridge recorder, the VCR-100, will be offered in October.

In addition to this range, a programmable broadcast cartridge recorder system, the BCR-200 has been developed. It has facilities for playing commercials and programmes in any random sequence.

Australian Video Engineering have moved to new premises at 231-233 Victoria Road, Rydalmere, 2116. Tel 638 6400.

BOOKS & LITERATURE

Memories, memories . .

SEMICONDUCTOR MEMORIES, edited by D. A. Hodges. Published by IEEE Press, New York, 1972. Soft covers, 216 x 277mm, 286pp, many illustrations. Price in Australia $6.00 (Clothbound $11.95).

A volume in the IEEE "selected reprints" series, designed to provide help for the hard-pressed engineer in learning about new devices and the application techniques which have been developed around them. This volume provides a convenient source of some 31 important recent papers on the field of semiconductor memory technology, for the computer and digital system designer and user.

The papers are divided into seven categories, designated by the editor as follows: 1 — Introduction to Semiconductor Memories; 2 — Bipolar Transistor Memories, Technology and circuits; 3 — MOS Transistor Memories, Technology and Circuits; 4 — Interconnections, Packaging and Economics; 5 — Reliability, Maintainability and Testing; 6 — System Examples; and 7 — Serial Memories and Content-Addressable Memories. A concluding section is used by the editor to give his conclusions and projections for future

A specialised volume, of course, but one which should be found of considerable value by the busy design engineer unable to plough through each and every issue of the learned journals.

The review copy came from John Wiley Sons Australasia Pty Ltd, who distribute IEEE Press publications in this country. (J.R.)

Colourful work

NEWNES COLOUR TV SERVICING MANUAL, Volume 1, by Gordon J. King. Published by Newnes Butterworths, London, 1973. Hard covers, 253 x 188mm, 232pp, many circuits and diagrams. Price in Australia $14.25.

Yet another book by the indefatigable Gordon King; this time a manual discussing the circuit, operation, setting-up and adjustment of nine major British colour TV receiver chassis of contemporary design. It has been written both as a study guide for the student and as a reference for the service technician. While it does incidentally give a good deal of basic information about PAL colour decoding, it is basically intended as a circuit study and complement to Mr King's other volume "Colour Television Servicing," which was reviewed in these columns previously.

Naturally the receivers discussed are all of UK manufacture, and designed for the British PAL standards. However because these standards are quite close to those set down for Australian colour (the main difference being a vision-sound carrier separation of 6MHz, as opposed to our separation of 5.499MHz), the educational value of the book for Australian readers should be almost as high as for those in the UK.

The book is quite well produced, with the general explanatory material written in Mr King's usual highly readable prose. Some of the material which is pretty obviously taken from manufacturer's servicing literature is a little variable, as are the quality of the circuits and diagrams, but this is understandable in view of the enormous cost which would have been involved in completely unifying the text and re-drawing the illustrations. The only other aspect I found mildly irritating is that the text is set in unjustified measure (columns with ragged right-hand sides); but this is perhaps only a personal reaction.

All in all, the book gives a good insight into PAL colour receiver designs of 1972-73 vintage, and as such should be of considerable interest and value to anyone trying to gain background in this area. For the serviceman looking for a way of becoming familiar with the sort of circuits he is likely to encounter in the first Australian colour sets, it would be a good choice.

The review copy came from the local office of the publisher, Butterworths Pty Ltd. Copies should be available at all major and technical bookstores. (J.R.)

Fine for courses

ELECTRONIC CIRCUIT ANALYSIS, by J. T. Wade, P. L. Edwards, and J. E. Clark. Published by John Wiley & Sons Australasia Pty Ltd, Sydney, 1973. Hard covers, 158 x 248mm, 640pp, many circuits and diagrams. Price in Australia $18.50 (soft cover edition $15).

A book written by three local technical academics to serve as a text for technical college students in electrical and electronics engineering, and also for students studying electronics as a supporting strand of another discipline such as chemical or mechanical engineering. It adopts a deliberately phenomenological approach to active devices, treating them largely as black boxes exhibiting certain basic behaviour, in order to avoid the heavy going and confusion which can be produced by highly sophisticated models. There is also considerable emphasis on the concept of "engineering approximation" as a practical design philosophy.

There are some 24 chapters, the treatment progressing from introductory concepts such as rectification and clipping, through diode, transistor and FET configurations, to vacuum tubes. Appendices at the rear of the book deal with basic semiconductor theory, tutorial problems, 8 sample test papers, and a topic index.

The text is clearly and concisely written, and is well served by illustrations. It is strongly orientated for use as a textbook for technical college courses, however, and because of this may be of less value to other readers. The emphasis is on mastering the practicalities of circuit analysis and design — at least to the extent of passing the appropriate examination. Those seeking a deeper insight into such basic concepts as device operation and switching logic will need to supplement it with additional reading.

For the intended purpose, however, it should certainly be found very suitable. It is well planned, well written and as up-to-date in approach as one would find in any published text.

The review copy came from the publisher, who advises that copies should be available from all major bookstores. (J.R.)

Sound colour text

COLOUR TELEVISION THEORY, by Geoffrey H. Hutson. Published by McGraw-Hill Publishing Co Ltd, London, 1971. Hard covers, 195 x 254mm, 326pp, many circuits and diagrams. Price in Australia $10.80.

A book which has already become justifiably popular as a text in technical colleges and universities. It is mainly concerned with the PAL development of the NTSC system, and is written for the engineer, technician or student who already has a good working knowledge of monochrome television principles.

There are 17 chapters, whose headings give a good idea of the overall scope and treatment: 1 — Light; 2 — Colour Television Signals; 3 — Colour-Bar Signals (NTSC and PAL); 4 — Basic PAL Coder, Transmitter and Receiver Arrangements; 5 — Receiver Display Devices; 6 — Convergence: General Principles; 7 — Convergence and Raster-shape Correction Circuitry; 8 — Chrominance Signals: General Principles of Quadrature Amplitude Modulation and Demodulation; 9 — Chrominance Signals: Principles of PAL Quadrature Modulation and PAL-S Demodulation; 10 — Chrominance Signals: Basic Principles of PAL-D Demondulation; 11 —Synchronous Demodulators; 12 — PAL-D Decoder Techniques: Chrominance Signal Delay-lines and Associated Circuitry; 13 — PAL-D Decoder Techniques: V-Channel Switching Circuitry; 14 — Chrominance Amplifiers and Associated Circuitry; 15 — Subcarrier Reference Oscillators and Associated Circuitry; 16 — Colour Difference and Luminance Amplifiers; 17 — EHT Systems and Receiver Design and Development. At the end of the book are two data appendices and a topic index.

The text of the book is clearly written, and presents the material in a logical manner. It is well served by illustrations and does not depend upon slabs of mathematical analysis, which should make it of value to a very wide range of readers.

In short, a very good choice for anyone seeking a sound basic text on colour TV theory in general, and PAL in particular.

The review copy came from the Australian office of the publisher, but copies should be available at all major bookstores. (J.R.)

Repeat program

1973 WORLD RADIO AND TV HANDBOOK, 27th Edition, edited by J. M. Frost. Published by World Radio-TV Handbook Co Ltd, Denmark. Price in Australia $5.95 plus postage.

This latest edition of the standard world broadcasting reference handbook was reviewed in the March 1973 issue by our short-wave correspondent Arthur Cushen. Since then a second copy has been received, from Technical Book and Magazine Company Pty Ltd of 289-299 Swanston St, Melbourne. This firm advises that they can post copies to readers in Victoria for 50c postage, and to readers in other states for 70c.

Right from scratch

A COURSE IN RADIO FUNDAMENTALS, fifth edition, by George Grammer. Published by the American Radio Relay League, Inc, Newington, Connecticut. Soft covers, 167 x 242mm, 184pp, many illustrations. Price in Australia $3.20 plus postage.

A completely rewritten fifth edition of the ARRL's well-known basic text, the first edition of which appeared in 1942. Unlike earlier editions it is completely self-contained, and does not use the ARRL Handbook to provide any of the reference material. Revision and updating have almost doubled its size over the previous editions, making it particularly good value for money.

There are 26 chapters, which start with electrical fundamentals and basic circuit behaviour and progress through device theory and similar topics to more advanced concepts such as feedback, RF amplification, neutralisation and impedance matching. Each chapter concludes with tutorial problems, the answers to which are given at the end of the book along with suggested experiments and a data appendix.

As one would expect, the book is well written and prepared. The text is clear and concise, and well served by illustrations. A quantitative approach is taken wherever appropriate, but never beyond the level served by elementary algebra.

In short, a particularly good basic text on modern radio fundamentals, and one which would be ideal both for individual study and for use by class and club groups.

The review copy came from Technical Book and Magazine Company, of 289-299 Swanston Street, Melbourne, who advise that they can supply copies by mail for 60c postage within Victoria, and 80c for other states. (J.R.)

AMATEUR BAND NEWS & NOTES

by Pierce Healy, VK2APQ

Rules for Remembrance Day Contest

The annual WIA Remembrance Day Contest rules, and details of award and certificate hunters' clubs are featured in this month's notes. There are also preliminary details of the proposed OSCAR-8.

Probably the most unusual contest, anywhere in the world, is the Remembrance Day Contest. Sponsored by the Wireless Institute of Australia for Australian and, more recently, New Zealand amateurs, it was inaugurated to perpetuate the memory of Australian amateurs who paid the supreme sacrifice in World War II.

The contest has no outright winner but is very popular among amateurs in Australia and New Zealand, even though many of those now participating knew little, if anything, about amateur radio when the contest was first held.

REMEMBRANCE DAY CONTEST

A perpetual trophy is awarded annually for competition between divisions of the WIA. It is inscribed with the names of those who made the supreme sacrifice and so perpetuates their memory throughout amateur radio in Australia.

The name of the winning division each year is also inscribed and the division receives a suitably inscribed certificate.

OBJECTS: Amateurs in each VK call area, including Australian Mandated Territories and Australian Antarctica, will endeavour to contact amateurs in other VK and in ZL call areas, on all bands.

Amateurs may contact any other amateurs on the bands above 52MHz, (i.e. intrastate scoring contacts will be permitted on the VHF / UHF bands).

CONTEST DATE: 0800 hours GMT Saturday, 18th August, 1973, to 0759 hours GMT on Sunday, 19th August, 1973.

All amateur stations are requested to observe 15 minutes silence before the commencement of the contest on the Saturday afternoon. An appropriate broadcast will be relayed from all divisional stations during this period.

RULES:

1. There are four sections:
   (a) Transmitting — phone
   (b) Transmitting — CW
   (c) Transmitting — Open
   (d) Receiving — Open
2. All Australian amateurs may enter whether fixed, portable, or mobile. WIA members and non-members are eligible for awards.
3. All amateur bands may be used and cross-mode operation is permitted. Cross-band operation is not permitted.
4. Amateurs may operate on both phone and CW during the contest, i.e. phone/phone, CW/CW or phone/CW. However, only one entry may be submitted for sections (a) to (c) in Rule 1.
   An open log will be one in which points are claimed for both phone and CW. Refer to Rule 11 concerning log entries.
5. For scoring, only one contact per band per station is allowed, except that a second contact on the same band using an alternative mode is permitted. On 52MHz and above, additional contacts may be made after two hours from the previous contact. Arranged schedules for contacts on the other bands are prohibited.
6. Multi-operator stations are not permitted. Log keepers are permitted, but only the licensed operator is allowed to make contact under his own call sign. Should two or more wish to operate any particular station each will be considered a contestant and must submit a log under his own call sign. Such contestants shall be referred to as "Substitute Operators." Their operating procedures must be as follows:—
   Phone: Substitute operators will call "CQ RD, or CQ Remembrance Day" followed by the call sign of the station, the word "log", and their own call sign, e.g. "CQ RD from VK4BBB log VK4BAA".
   CW: Substitute operators will call "CQ RD de" followed by the call sign of the station, an oblique stroke, and their own call sign, e.g. "CQ RD de VK4BBB / VK4BAA".
   Contestants receiving signals from a substitute operator need record only the call sign of the substitute operator.
7. Entrants must operate within the terms of their licence.
8. CYPHERS: Before points may be claimed serial numbers must be exchanged and acknowledged. The serial number of five or six figures will be made up of the RS (telephony) or RST (CW) reports plus three figures that will increase in value by one for each successive contact. If any contestant reaches 999 he will start again with 001.
9. Entries must be set out as shown in the example, using one side of paper only and standard WIA log sheets if possible.
   Entries must be clearly marked "Remembrance Day Contest 1973" and must reach the Federal Contest Manager, WIA, Box 638, GPO Brisbane in time for opening on Wednesday, 20th September, 1973. Early entries will be appreciated.
10. Scoring will be based on the table shown.
    Portable operation: Scores of operators working outside their own call area will be credited to that call area in which operation takes place, e.g. VK5-ZP / 2 will contribute towards VK2 total score.
11. All log sheets to be set out as in the example shown and in addition will carry a front sheet showing the following information:
12. The Federal Contest Manager has the right to disqualify any entrant who has not observed the regulations or has consistently departed from the accepted code of operating ethics.
    The Federal Contest Manager also has the right to disallow illegible, incomplete, or incorrectly set out logs.
13. The ruling of the Federal Contest Manager of the WIA is final and no disputes will be entered into.

AWARDS: Certificates will be awarded to the top scoring stations in sections (a) to (c) of Rule 1 in each call area, and will include top scorer in each section of each call area operating exclusively on 52MHz and above. VK1, VK8, VK9, VK0, ZL1, ZL2, ZL3, ZL4, and ZL5 will count as separate areas for awards. There will not be an outright winner.

Further certificates may be issued at the discretion of the Federal Contest Manager.

The Division to which the trophy will be awarded shall be determined in the following way:

To the average of the top six logs shall be added a bonus arrived at by adding the ratio of logs entered to the number of state licensees (including limited licensees), multiplied by the total points from all entries in sections (a), (b) and (c) of Rule 1.

VK1 scores will be included with VK2, VK8 with VK5 and VK0 with VK7. Also VK9 logs and score will be added to the division which is geographically closest. ZL scores will not be included in the score of any WIA division.

All contacts made during the contest must be shown in the log submitted, see Rule 4. An invalid contact must be shown but no score claimed.

Entrants in the "Open" sections must show CW and Phone contacts in numerical sequence.

Logs for all sections shall show at least five valid contacts. The trophy shall be forwarded to the winning Division and will be held by that Division for the specified period.

EXAMPLE OF TRANSMITTING LOG

DATE / TIME GMT	BAND	EMISSION AND POWER	CALL SIGN WORKED	RST No SENT	RST No. REC'd	POINTS CLAIMED

EXAMPLE OF RECEIVING LOG (S.W.L.)

DATE / TIME	BAND	EMISSION	CALL SIGN HEARD	RST No. SENT	RST No. REC'D	STATION CALLED	POINTS CLAIMED
Aug. 73							
14 0810	7MHz	A3(a)	VK5PS	58002	----	VK6RU	1
14 0812	" "	" "	ZL2AZ	59007	----	VK3K1	2
14 1035	52MHz	A3	VK4ZAZ	56010	----	VK5ZDR	2
14 1040	" "	" "	VK3ALZ	59025	----	VK3QV	1

VK SCORING TABLE

	To	VKO	1	2	3	4	5	6	7	8	9	ZL1	2	3	4	5
From	VKO	—	6	6	6	6	6	6	6	6	6	2	2	3	4	1
"	VK1	6	—	1	1	2	3	5	4	6	5	1	2	3	4	6
"	VK2	6	3	—	1	2	3	5	4	6	5	1	2	3	4	6
"	VK3	6	4	1	—	2	1	4	3	6	5	2	2	3	4	6
"	VK4	6	3	1	2	—	3	6	5	4	3	3	3	3	4	6
"	VK5	6	5	2	1	3	—	4	3	3	6	4	4	4	5	6
"	VK6	6	6	2	1	4	2	—	3	5	6	4	4	5	6	6
"	VK7	6	5	1	1	3	2	5	—	5	6	2	2	3	4	6
"	VK8	6	5	1	1	2	3	6	4	—	3	4	4	6	6	6
"	VK9	6	5	1	2	3	4	5	6	1	—	5	5	6	6	6

ZL SCORING TABLE

	To	VK0	1	2	3	4	5	6	7	8	9
From	ZL1	6	1	1	1	2	2	5	3	5	6
"	ZL2	6	1	1	1	2	2	5	3	5	6
"	ZL3	6	3	3	3	4	4	6	4	6	6
"	ZL4	6	4	4	4	5	5	6	5	6	6
"	ZL5	1	6	6	6	6	6	6	6	6	6

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, 2200.

RECEIVING SECTION (Section d):

1. Open to all short-wave listeners in Australia and New Zealand, but no active transmitting station may enter.
2. Contest times and logging of stations on each band are as for transmitting.
3. Logs shall be set out as in the example. The scoring table to be used is the same as for transmitting entrants and points must be claimed on the basis of the state in which the receiving station is located. A sample is given to clarify the position.
   It is not sufficient to log a station calling "CQ", the number he passes in a contact must be logged.
   It is not permissible to log a station in the same call area as the receiving station on the MF and HF bands, i.e. 1.8MHz to 30MHz, but on bands 52MHz and above, such stations may be logged more than once per band, for one point, on each occasion.
4. A station heard may be logged once on phone and once on CW for each band.
5. Club receiving stations may enter for the receiving section but will not be eligible for the single operator award. However if sufficient entries are received, a special award may be given to the top receiving station in Australia. All operators must sign the declaration.

AWARDS: Certificates will be awarded to the highest scorers in each call area. Further certificates may be awarded at the discretion of the Federal Contest Manager.

Note: The "one operator — one log" does not hold any longer. In future an operator may, in addition to his own log, submit a club and or divisional station log. However, more than one log under any one call sign is not acceptable.

AWARDS AND CERTIFICATES

Awards and certificate hunting is said to be the amateur equivalent to contests requiring physical skill or endurance, or which rely on patience and other skills exhibited in more subdued manner.

In whatever type, participants often come under adverse criticism due to their total pre-occupation, above all else, to add to their achievements. In spite of such criticism, it is one of the popular facets of amateur radio that has an intriguing challenge for many operators.

Two international organisations cater for those interested. Details of these organisations have been supplied by two well-known Australian amateurs who represent these organisations.

The Award Hunters' Club International

The Award Hunters' Club International (AHC) is incorporated in Finland and divided into six Continental Sections. These Sections are independent but all follow the same general principles in the membership rules. The Club was established at the end of 1957.

The "AHC" headquarters has the following main tasks:—

1. to co-ordinate the activities of the continental AHC Sections.
2. to keep a register of World Awards and Certificates (published as the "AHC Bulletin").
3. to maintain the "XL-Club" as a goodwill recognition to highly skilled amateurs all over the world.

Award hunters may join their own Continental Section.

AHC-O covers amateurs resident in Oceania which includes Australia, New Zealand and Pacific areas.

Requirements for membership:

1. Basic membership requires a minimum of twenty-five different certificates and must comprise the following:—
   (a) At least ten official certificates, i.e. certificates sponsored by the International Amateur Radio Union member societies.
   (b) Not more than ten certificates may be from one's own continent.
   (c) At least four continents must be represented in the list of certificates submitted.
   (d) Certificates issued on contacts on national or international basis only will count.
   (e) Regardless of class or endorsement, the same certificate may be counted only once.
2. Endorsement stickers will be available for 50; 100; 150; 200 and 250 certificates. At least one third of the certificates submitted for endorsement must be official. (Note local certificates may be used for endorsement purposes.)
3. General restrictions:
   (a) Contest certificates do not count.
   (b) Certificates available only to members of certain clubs or countries do not count.
   (c) Different classes or endorsements of the same certificates do not count separately except in case they represent single-mode and / or single-band operation (single-band-single-mode counts together), or in the case of century certificates representing additional centuries 200, 300 etc.
   (d) Certificates given for similar or practically similar requirements do not count as different awards, except in the case of annual awards bound to calendar year or any part of it.
   (e) The mixed version of the certificate is omitted when any single-mode and / or single-band endorsement is submitted for credit.
   (f) Club membership certificates do not count except the DXCC, A-1 Operators Club and the XL-Club.
   (g) Certificates having a political background do not count.
   (h) Certificates issued for three contacts or less do not count.

   A summary of official awards is available from AHC Headquarters.
4. Application: Send your continental AHC secretary a list of your certificates giving the abbreviations of the award names in alphabetical order, full names of the awards, number and / or date of issue, possible endorsements. Certify the correctness of the list with your own signature. No other certifications are necessary, but any falsification in the application will lead to disqualification.
5. Fees: Registration fee, giving life-long membership, is based on $US1.00. Equal amount of any currency or IRC's may be used upon agreement with your Continental AHC secretary.
   The Continental Sections may fix an active membership fee in order to finance their intercontinental activities. This is an internal matter and does not affect the general lifelong membership.
   Sufficient return postage should be included in all correspondence from applicants or members to the AHC-Hq / AHC Continental secretary.
6. The decisions of the AHC International Board will be final and right to change the rules is reserved.

The continental secretary for Oceania (AHC-O) is
Alan Shawsmith, VK4SS,
35 Whynot Street,
West End, Brisbane, Q 4101 Australia.

The International Certificate Hunters' Club

In the note received from Alan his comments were:

"Are you interested in obtaining awards of merit and achievement? AHC will bring you the latest, most accurate and up-to-date information on all the worthwhile awards from every continent.

"Award Hunters cop a lot of criticism and some of it is justified. To many, awards are of little value. However, AHC aims to keep the standard up by the rule that all those who seek membership must hold a certain number of official awards."

Alan extends an invitation to those interested to write to him for further details.

The International Certificate Hunters' Club is an amateur achievement, honour, service fraternity open to amateurs worldwide. Membership cannot be bought, it must be earned.

Chapter No 66 of the "CHC" has been formed in Australia, the officers are:

President: Alex Slight, VK2ZA.
Vice-president: Jim Cunningham, VK3APL.
Secretary / treasurer and Awards Custodian: Jack Gutcher, VK3APU.

Some details of membership and an award sponsored by the Australian chapter were received from Alex Slight, VK2ZA. These should interest active operators.

Membership is not a simple matter of making application and paying dues, but is dependent upon a points system which covers many aspects of amateur activity. Such as, membership of the national radio society, regional radio clubs, offices held therein, contributions to amateur radio magazines, various DX certificates and awards held etc.

In other words, membership is a good measure of the involvement of the prospective member in amateur radio. A minimum of twenty-five points is required for full membership and a minimum of twelve points for associate. Any amateur who would like full details should write to any of the three officers at their call book address, or to CHC Executive Secretary, Clif Evans, K6BX, 3212 Mesa Verde Rd., Bonita, California 92002 USA, enclosing one international reply coupon (IRC) and a self-addressed label.

With the object of stimulating activity on all amateur bands, particularly the lower bands, 3.5MHz and 7.0MHz, and to encourage Australian amateurs to go mobile and portable to offer co-operation and assistance to fellow amateurs here and overseas, two Australian awards have been instituted, based on the 125 Commonwealth Electorates.

The basic award will be given for working 25 electorates, with specified numbers in each state. The major award will be issued for working all 125 electorates.

The two awards are known as the "Australian Commonwealth Electorates Award" or "ACE" and the "ACE 125".

Full particulars of the awards, which are open to amateurs worldwide, may be obtained by forwarding 20 cents in stamps to — J. C. Gutcher, VK3APU, 17 Foulds Court, Montrose, Victoria 3765.

To quote a comment by Alex, VK2ZA — "Don't be surprised if some fellow amateur says 'What is your federal electorate OM?' — please note it is the federal not state electorate that is required.

"Well do you know? — you would be surprised how many vote but don't know their electorate. Perhaps these awards will also help to generate further knowledge and interest in our own country."

The formation of the Australian chapter and inauguration of the award was inspired by the "New Zealand Counties Award," originally sponsored by CHC Chapter No 67 in New Zealand but now sponsored by the NZART, the New Zealand national society.

It has been stated that making contacts with stations in all of the 112 New Zealand counties is much more difficult than the DXCC award. At the present time only two amateurs in Australia, VK2ZA and VK4LZ, have gained the award.

Amateurs in Australia and overseas have been impressed by the trouble to which New Zealand amateurs will go to provide contacts from counties in which there are no resident amateurs. Many have travelled many miles to operate mobile or portable from such counties. Even to the extent of flying across to Stewart Island.

AMSAT-OSCAR NEWS

During the weekend 23rd-24th June, 1973, state cordinators of the WIA project AUSTRAIS group met in Melbourne to discuss operation of OSCAR 6, currently in orbit, and OSCAR 7 which is being prepared for a possible launch in 1974. Also, a suggestion that OSCAR 8 be constructed in Australia.

The WIA OSCAR project group would like to receive any ideas that Australian amateurs may have on frequencies and systems which might be incorporated in OSCAR 8.

At the time of compiling these notes the information on AMSAT-OSCAR-B (OSCAR 7) was that three translators would be incorporated in the package. These would be a 70cm to 2m translator and two 2m to 10m translators. One will have somewhat higher power than the present OSCAR 6, and the other, more or less identical to OSCAR 6, will be used as a backup system. Only one translator will be operative at any one time.

Present plans for the 70cm translator call for an up link range of 432.125MHz to 432.175MHz and a down link range of 145.925 MHz to 145.975MHz. The unit will employ frequency inversion, so that, neglecting Doppler shift, an input at 432.125MHz will be retransmitted at 145.975MHz. Input using upper sideband will be retransmitted as lower sideband. When this translator is in use, a telemetry and codestore beacon will be heard on 145.980MHz.

The 2m to 10m translators will employ identical frequency bands. The uplink range will be the same as OSCAR 6, 145.900MHz to 146.000MHz. As with OSCAR 6, frequency inversion will not be used. The 2m to 10m mode will incorporate two beacons, as with OSCAR 6, one at 435.100MHz, the other at a frequency in the 10m band to be decided.

In addition to the OSCAR 6 configuration, in which the beacon at 29.450MHz is used in conjunction with a downlink range of 29.450MHz to 29.550MHz, two alternatives are under consideration. Were it deemed desirable for the beacon to remain at 29.450MHz, the downlink range could be shifted to 29.350MHz to 29.450MHz. Alternatively, the beacon could be moved to 29.500MHz and the downlink placed at 29.400MHz to 29.500MHz. Many users have expressed regret that the OSCAR 6 downlink extends above 29.500MHz, since tuning that range is inconvenient with several popular receivers in current use. As a consequence, OSCAR 6 activity has been concentrated in the lowest 50KHz of its passband.

Information from AMSAT indicates that the lifetime of one year expected of OSCAR 6 will be achieved. There is some evidence of battery degradation but this is not necessarily an indicator of shortened life.

However the complete co-operation of all users in relation to radiated power limitations and operating schedules is essential.

WIRELESS INSTITUTE ACTIVITIES

The FM Repeater Scene

To give an up-to-date precis of the situation regarding FM repeater channels, requires the proverbial crystal ball; particularly if the information is to be read four to six weeks after it is written.

Since last month's comments were written there appears to be nothing which warrants any change in the thoughts expressed.

Official statements, from four of the six WIA divisions, were published in the June issue of the Institute's magazine "Amateur Radio". However, as the WIA journal is circulated only to members, it must be

difficult for nearly 50 per cent of Australian amateurs who are not members to evaluate the situation.

Unfortunately space does not permit a complete review of all the facets of the confusing situation.

However, to sum up the problem in a few lines:

The Victorian proposal demands a major change in the current FM repeater and simplex frequency channels, on the basis of possible interference to amateur satellite users in the 144.80MHz to 146.00MHz section of the band. Other points are stated, but the emphasis is placed on the amateur satellite service.

The New South Wales view insists that only a minor change is necessary, that is, move the 145.9MHz channel 4 repeater output. This is confirmed by a statement received from AMSAT that 145.80MHz to 146.00MHz is the portion of the band to be used for the amateur satellite service. Other points are made, relating to technical aspects involved.

There are many side issues that have been brought into the confrontation. All seem to cloud the basic point from which the controversial proposal has snowballed — the possibility of interference to users of amateur satellite OSCAR 6.

Now WIA internal political overtones and inter-division lobbying are adding to the confusion.

One submission which was conspicuous by its absence in "A.R." was that from the federal repeater committee (formerly the FRS). Particularly as this committee has the task to consider all proposals and make recommendations to federal executive. Federal executive, in turn, should seek ratification of such recommendations by all divisions by postal vote or, should any one division request, hold the matter over for discussion at the next federal convention.

In view of the responsibilities and procedure outlined above, it is understood that quote ". . . a postal vote is under way to divisions." (QSP A.R. p2 June 1973). But the recommendations to be voted on are not those of the FRC, but those being sponsored by the council of the Victorian Division.

However, the report of the FRC, dated 12th May 1973, is published in the June issue of "Tuned Lines," the official journal of the VHF & TV Group of the NSW Division. Also in that issue is a chronological summary of events; discussions which took place and proposals put forward during the period Easter to mid-May 1973.

A rider to the FRC report may sum the situation up; "The above report was sent to Federal Executive for publication in the June issue of A.R. but communication from Peter Dodd (Business Manager, Federal Executive), indicates that it is unlikely to appear as 'there were no reports from either Australis or VHF advisory committee to balance it'.

"This attitude would seem to follow the previous one of not presenting information of an anti-change nature to members."

From the tone of the rider, which appears in the form of a statement after the names of the members of the Federal Repeater Committee, it will no doubt be realised that the FRC report does not favour any major change.

The irony of it all is that WIA Federal Executive has announced the appointment of three members from NSW as the FRC, but had not thought fit to let members know the committee's recommendations.

CUSTOMS DUTY

Most welcome news this month concerns customs duty on amateur equipment. Apparently continuing representations to the authorities by business organisations, the WIA, "Electronics Australia", and numbers of individual amateurs have at last borne fruit.

While matters are not finalised at the time of writing, the authorities are currently modifying the regulations to permit duty free entry of typical six-band transceivers covering the 10, 15, 20, 40, 80 and 160 metre amateur bands.

Even though the formalities may still be sufficiently formidible to deter all but the more enthusiastic individuals, the way would seem to be open for local distributors to import such items duty free, and to pass this saving on to their customers.

A point to remember about the situation is that the Radio Branch, PMG's Department, when announcing the approval for the use of unattended VHF repeaters by Australian amateurs in 1968, stated:

"The Department suggests that, wherever appropriate, the local WIA organisation should co-ordinate applications . . ."

It was this suggestion that brought about the Wodonga meeting in 1969 which drew up a frequency plan for repeater and simplex operation in the 145MHz to 146MHz segment of the band. Also, the formation of a Federal Repeater Secretariate. To date all applications have been co-ordinated through the FRS.

Radio Museum

The council of the NSW Division, WIA, is endeavouring to gather old radio units and components suitable for historical display, showing the type of amateur equipment used in the years gone by.

Anyone having such items, wishing to assist the project, is invited to contact the Administrative Secretary, 14 Atchison Street, Crows Nest, 2065.

Central Coast Amateur Radio Club

The Gosford Show Society has again offered space to the Central Coast Amateur Radio Club at the district show, 22nd and 23rd September, 1973. The club appreciates this gesture and will be arranging an exhibit to publicise various aspects of amateur radio. Members will erect antennas for the event and it is hoped that these may be permanent, as the site is the venue for their popular annual field day.

Already preliminary discussions have been held regarding the annual field day, normally held early in February.

The final date will be decided when information is available from other clubs holding events in February.

The CCARC hold meetings on the first and third Friday of each month. Visitors welcome.

For details contact the secretary, Barry Gibbins, Gosford, telephone 25 1746 or write to Box 238, PO Gosford 2250.

Geelong Amateur Radio Club

The third Geelong Hamfest was held on 26th and 27th May, 1973. The event was organised by a joint committee of members of the Geelong Amateur Radio & TV Club and the Geelong Radio and Electronic Society. The committee members were:—

Bob Wookey, VK3IC; Harry Michael, VK3ASI; Will Chandler, VK3ZSN; Mike Tricket, VK3ASQ; Colin Lowne, VK3ZZS; Bill Erwin, VK3WE and Alan Bradley, VK3LW.

The event proved to be the most successful yet, with 140 registrations, and an attendance of more than 250. This number posed quite a catering problem, but this was handled very successfully by the hard working ladies of both clubs. Appreciation of their efforts was shown by the enthusiastic applause from all present. The committee also thanked all who generously donated tasty dishes for the meals.

Prizes and technical literature were donated by R. H. Cunningham, U.E.S. Geelong, Layfaette Electronics, HI-Q Crystals, Radion Parts Pty Ltd, Motorola Semiconductors and Schlumberger.

Trade displays were provided by Fred Bail — Bail

Electronic Services, and Alf Forster — Brownbill Amplifiers.

All contests were keenly contested and the following were awarded prizes.

1st 144MHz AM Scramble — 1st VK3ZDW; 2nd VK3NM. 2nd 144MHz AM Scramble — Equal 1st VK3-BMD, VK3ZDW; Equal 2nd VK3NM, VK5DK. Sniffer Hunt — 1st VK3AUI; 2nd VK3YAV. 80 metre contest — 1st VK3BEV; 2nd VK3BCH. All channel FM Scramble — 1st VK3ASV; 2nd VK3YGH. 1st 40 metre Scramble — 1st VK3ASI; 2nd VK3TN; 2nd 40 metre Scramble — 1st VK5TH; 2nd VK3TN. FM Channel B contest — 1st VK3YGX; 2nd VK3ASV. Best Home Built Gear — 1st VK3ASV; 2nd VK3YFL.

For information, write to the Secretary, Geelong Amateur Radio & TV Club, PO Box 520, Geelong, Victoria 3220.

WIA YOUTH RADIO SCHEME SOUTH AUSTRALIA

On Saturday, 16th June, 1973, the Youth Radio Club Scheme in South Australia held its annual general meeting. Twenty club leaders from metropolitan and country areas attended.

The host was Prince Alfred College, where there is a strong youth radio club with many enthusiasts among the students. A message of welcome from the headmaster was read by club leader and teacher, Mr Phil Emery.

Mr Geoff Taylor, VK5TY, president of the SA Division WIA addressed the meeting. A letter and report was received from the YRCS federal co-ordinator Rev Bob Guthberlet.

This year there were some new faces from Pt Augusta and Renmark, as well as from the city area. Club leaders and instructors exchanged ideas on the running of clubs, enabling them to keep up to date on the development of YRCS throughout the state.

Mr Lloyd Douglas, VK5LL, demonstrated several re-usable project kits used at the Pt Augusta Youth Radio Club.

Typical kits included a "push pull" crystal set, simple multimeter, regenerative broadcast receiver, audio amplifier intercom unit. The member builds the kit using the parts, layout drawing and circuit provided, has the project tested and assessed for workmanship, and then disassembles it ready for use by the next club member. The system is particularly useful for members without a project of their own to carry on with. Also on display were a number of YRCS project kits available from the YRCS project officer in Victoria.

The committee elected is: Supervisor, Mr Allen Dunn, VK5FD; Secretary: Mr Noel Kohler, VK5DV; WIA Liaison officer, Mr John Allan, VK5UL; Country Representative, Mr Lloyd Douglas, VK5LL; Metropolitan Representative, Mr Phil Emery.

Mr Steve Johnston did not seek re-election as secretary in order that he may concentrate his YRCS interests into the Boy Scout organisation, including the Jamboree-on-the-Air.

A new club is the Sacred Heart College Youth Radio Club, under the guidance of Mr Leo Powning. Theory lessons are held on Friday nights after school, with practical work on Sunday afternoons.

The senior class at St Marys Boy Scouts Youth Radio Club have started work on a transmitter and receiver for the proposed novice bands.

At Pt Augusta Youth Radio Club some of the senior class are learning Morse code under the guidance of Mr Don Martin, ex VK9DM.

The Third Adelaide Boys Brigade Club have only a small number of boys this year but the interest is strong. Instructor Mr Mike Bloodworth, VK5LX says that there may be an elementary certificate candidate in the near future.

Elizabeth Youth Radio club members have been busy making up one transistor amplifiers using veroboard construction. These will be used to increase the volume from their crystal set projects. Club members are given the opportunity of purchasing the completed projects.

Pt Pirie Youth Radio Club are working on their new clubrooms. Water and power are yet to be completed but most of the benches for practical work are in position and the tables and chairs repaired and painted.

NEW SOUTH WALES

Maitland Radio Club

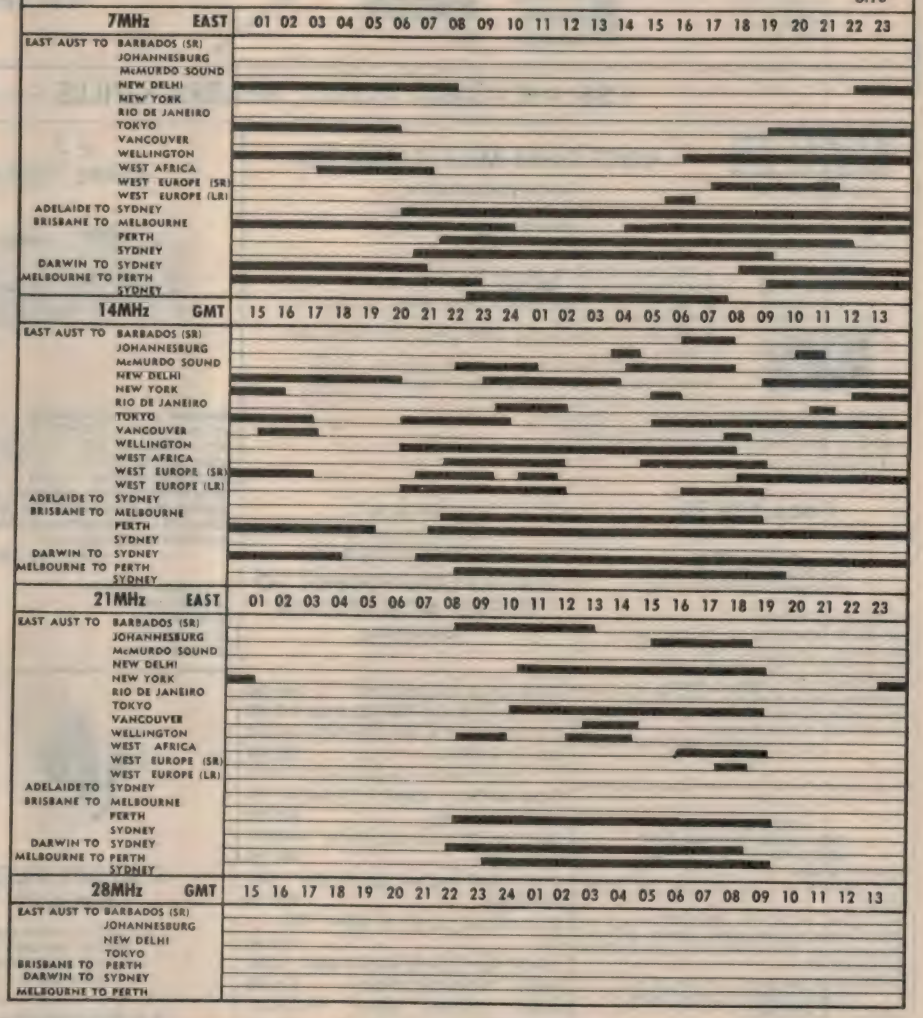
The erection of the Maitland Radio Club's new 22 metre high tower was featured in the Maitland Mercury. The local TV channel NBN 3 also screened it as part of the regional news segment. The task was carried out by the Hunter Valley County Council.

On top of the tower is a 146MHz ground plane antenna, other VHF antennas will be installed at various levels. Between the two towers now installed a multiple dipole system of HF aerials will be erected. Although self-supporting, a set of stabilising wires have been fitted, these are insulated from the tower and ground and will also be used as receiving aerials for class built projects.

IONOSPHERIC PREDICTIONS FOR AUGUST

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). They have been prepared for the four most popular amateur bands over a number of interstate and international circuits. Black bands indicate periods when circuit is open.

8.73



A new 30 watt sound system built by members has been installed in the club theatrette. This will provide high quality sound reproduction in the social section of the club. Work has also been done on a two metre transmitter and receiver to be used for class instruction.

Technical films are now a feature of the instruction classes. These are shown at the conclusion of the theory section class each night.

Inquiries about club activities may be obtained from the Secretary, PO Box 54, East Maitland, 2323 NSW.

Westlakes Radio Club

The Westlakes Radio Club issues handsome certificates to members who show prowess in medium-wave and short-wave listening. These certificates are not difficult to win. They are also issued to non-members, when a fee of 60 cents is charged.

To gain the Broadcast Ten the listener must receive QSL cards from stations in the medium-wave band in the following schedule.

Four stations in New South Wales.

Three stations in any of three other states of Australia.

Two stations in New Zealand (one from each island) or one from New Zealand and one from New Guinea. One station from any other country outside Australia, New Zealand and New Guinea.

To gain the Short-Wave Ten, the listener must have received verifications cards or letters from two stations in each of the five continents, Europe, Asia, Africa, North America and South America.

Each station must be in a different country.

For purposes of the award, Great Britain, Japan and other island countries are considered part of the continent to which they are adjacent.

If your interest lies within the amateur band activities then amateur radio QSL cards for these areas will be accepted. Either short-wave or amateur station QSL cards will be accepted, but a mixture will not be acceptable.

To gain the awards, applicants should present their verifications to the secretary.

For information on all activities of the club write to Secretary, Eric Brockbank, VK2ZOP, PO Box 1, Teralba 2284, NSW.

50 WATT SOLID STATE GUITAR AMPLIFIER

50 watts RMS solid-state guitar amplifier. PM125 4 inputs, 2 channel with separate volume, bass and treble controls; speed and intensity controls for vibrato. Remote foot switch with plug and lead. Black vynex carry cabinet.

Fully constructed and ready for operation off 240VAC $125.50

GUITAR SPEAKER CABINET

Upright floor model, black vynex covering, 34" x 18" x 12", sloping front, contains innerbond packing and two Rola 12U50 12" speakers.

$115.00

15" PIONEER

15in Pioneer low frequency speaker, imp 16 ohms. Power, 30 watts RMS designed especially for use with bass guitar or electric organ. Also ideal for stereo woofer speaker.

$33.00

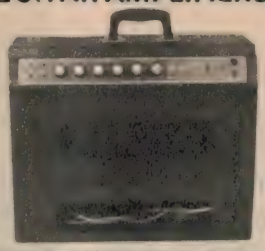
ROLA 50 Watts R.M.S. LOUDSPEAKERS

Model 12U50 Bass $35.00

Model 12UX50 Extended Frequency $40.00

P&P $1.50

SONATA GUITAR AMPLIFIERS



2 channels, 4 hi-imp inputs, 2 separate volume controls — separate bass and treble controls, speed and intensity controls for vibrato (tremolo) with remote foot switch with plug & lead. Attractive black vinyl covered carry cabinet.

8" heavy duty speakers
20 watts RMS $93.00
35 watts RMS $129.00

M.S.P. 8-15 OHMS

Latest Model Speakers
LF — 6WAC 6" $10.50
LF — 6WACX 6" twin $11.50
4MBC TWEETER $4.50
12PQC8 / 30 30 watts $22.95
8TACX 8" twin $9.75

12 PQ 15 OHM only $15.95 2 MBC tweeter $4.50.

OVAL SPEAKERS

9" x 6" 3,5,8 or 15 OHMS	$6.95
7" x 5" 8 or 15 OHMS	$5.75
6" x 4" 8 or 15 OHMS	$4.75
6" x 2" 8 or 15 OHMS	$4.25
5" x 3" 8 or 15 OHMS	$3.75
4" x 2" 8 or 15 OHMS	$3.50

PLAYMASTER 136 STEREO AMPLIFIER

As per Dec 72 E / A
Full kit including fairchild transistors $62.50
Fully constructed and tested $75.00
Metal work only $7.65
P.C. boards $8.00

REVERBERATION UNITS

Freq. response. 60-3000 Hz.
Decay time 1.5 seconds.
Dimensions 4¾ in x ⅜in x 1¾in
$6.95 P & P 50c

SPECIALS

Plessey SL — 403D 1—C Units $4.50 EA. Brands 5.7" 1800 FT Mylar $3.50, 3600 ft 7" Mylar $4.50, Cassettes BASF soft pack C60 $1.35, Brand 5 C60 plastic pack 90c Brand 5 C90 plastic pack $1.70 8 OHM 3" pillow phone in plastic housing works with tranny or cassette. $2.50. Crystal lapel Mic $2.00, Crystal contact Mic $3.00, Burglar alarm. Extra loud squarker — suit car or home. Battery operated. $1.75.

STEREO RECORD PLAYER

240V AC — 4 speeds, ceramic cartridge. Separate motor, 7in turntable, pickup arm and rest. Post 50c.

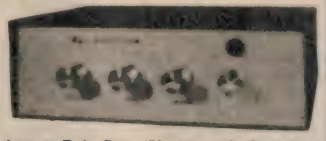
$7.90

MAGNAVOX WIDE RANGE TWIN-CONE SPEAKERS

8 — 16 OHMS
30 — 16,000 Hz
6WR MK5 12-W RMS $9.90
8WR MK5 16-W RMS $10.75
10WR MK5 16-W RMS $11.50
12WR MK5 16-W RMS $12.50

Pack and Post 65c.

MUSICOLOUR II



As per E.A. Dec. '71, Jan. '72. Complete kits of parts $49.50
Fully constructed $59.50
Pack & post 75c
P.C. BOARD ONLY $3.25
SPECIFIED TRANSFORMER ONLY $4.35

SOLDERING IRON

240V AC 30 watts. Lightweight 2½oz. Heating time 1.8 mins.

$7.25

CAR SPEAKERS

4 or 8 OHMS. Suitable for radio cassette or cartridge $7.75 EA. $15.00 Pair. P & P 75c.

CAR AERIAL

Standard car aerial $3.50
Lock down car aerial $4.50

PHILIPS

Model AD 0160 T8 1" Dome Tweeter, $10.00 P & P 50c.

STEREO RECORD CHANGERS

C129 — C141 — C142 — C142A3

Current models, 4 speeds, automatic or manual operation.

Ceramic cartridge, Sapphire stylus. Standard model with 12in turntable. $34.00

Deluxe model with 12in turntable, Cueing device, ceramic cartridge, diamond stylus $40.00

Deluxe model as above with an adjustable counter balance, 2 spindles, calibrated stylus pressure control added $46.50

Deluxe model as above with 12in Diecast Heavyweight turntable, 4-pole shielded motor, suitable for Magnetic cartridge $56.50

The latter two record changers can be supplied with magnetic cartridge and diamond stylus at $10 extra.

PERSPEX COVER

Smoke Tinter 17¼" x 13½" x 4½" $9.00. P & P 60c

Pre Cut Mounting Platform Teak and Walnut 18¼" x 15" x 3½" $11.50. P & P 75c.

Top Quality padded stereo phones

Delux model with slide volume controls 18.20,000HZ 8 OHMS Special price offer. $7.90. Standard model, 20-12,000HZ. 8 OHMS, $4.70 P & P 40c.

Famous Zennheiser HD 414 $25.95

SOLID STATE FOUR TRACK CASSETTE STEREO TAPE DECK

240V 50 Hz operation, 2 V-U meters piano key push buttons. Record and erase facilities. Pause. Mic input 200 OHMS. Line input 300K OHMS. Output IMP 10K OHMS S / N radio better than 40 dB. Crosstalk better than 50 dB T TO T 25dB CH to CH freq 50 — 10,000 Hz size 2½" x 12½" x 9½" WT 7 lbs.

$132.50.
P & P $2.50.

Rotating Distress Emergency Beam

Fire Brigades and Rescue squads use them. So do Car, Truck and BOAT OWNERS WHO VALUE THEIR SAFETY. At home on party nights, have a light show. Red, Blue, Amber — visibility ½ mile. 12v DC 1 amp operation, waterproof. Complete with heavy duty suction cap. Size 3½" dia. x 5½" $5.75. Pack and post 35c.

SONATA NS-1600D

All silicon solid-state Hi-Fi Stereo Amplifier. 10 watts RMS per channel. Each channel has separate Bass Treble controls. Inputs for magnetic or ceramic cartridge, crystal mic., radio, tape — tape out; stereo headphones. 8 — 16 ohms. Instruction booklet, circuit supplied. Timber cabinet. Dimensions: 14½" x 8" x 4".

$67.50 Plus Freight $2.50

GARRARD

Stereo Changer. Model SL 65B. 3 Speed Auto. Aluminium turntable. Cue & pause control. Counterbalanced bias compensated. Syn-motor, with ceramic cartridge, diamond stylus. $88.00. P & P $1.50.

STEREO PLAYER

MODEL SP 25MK III 3 Speed. 4 pole motor. Aluminium turntable. Fully balanced & CALIBRATED P.U. arm. Bias comp. cue & pause control. Click supressor. Auto. Set down.
Excluding cartridge $55.80. P & P $1.50.
Also available.
Garrard-Zero 100 $177.80.
Garrard SL72B $97.00
Mounting base with perspex cover $23.80.
Dual 1214 $88.00.
Dual 1216 $110.00.
Dual 1218 $140.00.
Mounting base & cover $29.00.
Cartridge not included mag cartridge available to suit all models. Extra $10.00.
Send S.A.E. for specs any model.

AIWA COMPACT CASSETTE CAR STEREO

Complete with speakers. 12 volt neg. Ground operation Starr Capstan drive: Output 5 Watts per CH. Freq response 50-10,000 Hz Tape Speed 4.8 CM / P. SEC S / N Ratio Better than 45dB, $112.00, P&P $2.50.

MAGNAVOX 8 / 30 SYSTEM TEAK OR WALNUT

1.6 cft complete $58.00 ea.
8.30 Speaker $16.50 ea
3TC $3.40 ea
Fully built cabinet $32.00 ea.
Cabinet kit $22.00 ea

MULLARD MAGNAVOX BOOKSHELF SYSTEM TEAK OR WALNUT

6WR MK5-3TC 8 or 16 ohms 15½ x 8½ x 8½ complete
$31.50 ea.
Cabinet only $13.90.

Sonata NS — 1600

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LISTENING TO THE WORLD

by Arthur Cushen, MBE

Listeners often receive a pleasant reward for their listening efforts in the form of cards verifying their reception reports. In recent weeks a variety of interesting countries have been represented in the mail received by some of our readers.

A relatively new listener, sending reports to the better known international broadcasters generally receives a prompt reply by airmail to his report. When he turns his attention to the lower powered stations he may become frustrated at the delays in receiving verifications, particularly from South America. However, the rewards are worth waiting for. One of our readers Chris Davis of Featherston, NZ has had considerable success from this part of the world, with eight verifications out of 22 reports; this is a good percentage for this area. Registered mail, return postage and the inclusion of mint stamps are some of the ways in which one can motivate the station to verify. Chris Davis now has 92 verifications from this area, many from low power stations. Our own verifications from South America total 315 from every country on this continent.

BOLIVIA: Radio Nacional, Cochabamba has verified to Chris Davis of Featherston, NZ with a letter in English concerning his report on 5975kHz at 1030GMT. The letter stated that the broadcasts at that time were in the local Indian dialect; all stations in Bolivia must devote three hours of their program each day to the minority group. The letter was signed by Jimmy Christie, Engineer, Radio Nacional, Cochabamba, Casilla No. 526, Cochabamba, Bolivia.

AZAD KASHMIR: A verification card has been received from Azad Kashmir on 4732kHz by David Foster, Kew, Vict. The card, brown in colour, was signed by the Station Manager. This is one of the few verifications from this station received in Australia.

SYRIA: Damascus using 9655kHz for its general overseas service has verified for Bob Padula, Melbourne, Victoria with a multicoloured card showing a map of the world. They also sent along a badge with the insignia of the station. Damascus has been a "non-verifier" for several months and this news will be welcomed by those who have recently written to Syria.

HONDURAS: Radio Juticalpa on 4780kHz was heard at 1030GMT and verified for Chris Davis with a letter in English. The transmitter is 1000 watts on this frequency. As well as the letter, they enclosed a large gold and green pennant.

CHILE: Radio Corporacion on 6190kHz verified a report in Spanish in 14 days in response to a letter from Chris Davis. This was a coloured post-card of a tourist attraction near Santiago. The verification stated that they had two other transmitters CE 950 and CE 1515 also in operation. Our own verification of CE 1515 was in the form of a pennant. It is one of the largest we have ever received, but it was issued by the station over 20 years ago and shows an eagle sitting on top of the microphone.

HONDURAS: Radio Progreso was heard on 4920kHz at 0430GMT and verified for Chris Davis with a letter in Spanish which gives the power on this frequency as 1500 watts. The address is Apartado 20, F1 Progreso, Yoro, Honduras. As well as the letter, a pennant in green, black and white was also received.

VQ09 on 9545kHz

The Solomon Islands Broadcasting Service is using a new frequency for its lunch-hour transmissions. The transmission commences at 0111GMT on 9545kHz with the usual drumbeats and ends at 0300GMT after the lunch-time program. Two Wellington listeners John Mainland and Bryan Clark report reception of this new service, but interference has been noted from Deutsche Welle at Cologne, which also uses the frequency from 0130 to 0250GMT. This means that the Solomon Islands station can only be heard free from interference from 0111 to 0130 and for the last ten minutes of the transmission. According to a verification received from the station, the call sign is VQ09. The report from John Mainland was the first they had received on the new frequency.

BRUNEI ON 7215kHz

Good reception is being experienced of Radio Brunei on 7215kHz from as early as 1000GMT when programs in Chinese are being broadcast. At 1400GMT, during the English program, a full identification is given; local time is 10 pm.

According to the latest schedule in the ADXN the station is operating on 4865kHz as follows:

GMT	Language
2200-0600, 1100-1430	Malay
On 7215kHz	
2258-0030, 0300-0500, 1200-1430	English
0030-0300, 0800-1100	Chinese
1100-1200	Ghurka

The power on both frequencies is 10kW, according to a verification received by Geoff Cosier of Burwood, Vic.

ENGLISH FROM BEIRUT

Radio Lebanon has three transmissions to overseas audiences, and two of these include 30 minute broadcasts in English.

In the service to North and South America from 0130-0400GMT the frequency of 11790kHz is now used, and English is broadcast from 0230-0300GMT. The service to Europe and Africa from 1830-2030GMT is on 15170kHz with English from 1830-1900GMT. The third transmission is to South America and is broadcast from 2300-0100GMT on 15355kHz. Reception on 11790kHz is very good during our afternoons, while the broadcast at 1830GMT is received at fair strength. The transmission on 15355kHz is blocked by Radio Australia after 0030GMT, but before this time reception is possible.

MENDI ON 3275kHz

The latest station to commence operation in Papua New Guinea is Mendi using 3275kHz. The station uses the slogan "Radio Southern District" and is heard opening at 0800GMT. Our reception of the singal has been best around 1000GMT when news in Pidgin is broadcast.

The remaining stations to commence operation this year in Papua New Guinea are Alotau (3360), Port Moresby (3925), Kavieng (2428), Vanimo (3205), Lorangau (3905) and Kimbe which has not yet been assigned a frequency.

SPLIT FREQUENCY RECEPTION

One of the most interesting aspects of long distance medium-wave reception is the use by stations of "split" frequencies which are not multiples of 10. This enables the listener to hear broadcasts over many thousands of miles. Around dawn the Europeans can be received and as they use a 9kHz separation, they come up on the dial between the Australian and New Zealand stations.

In the evenings in New Zealand we are also enjoying reception on split frequencies from stations in Central and South America. The best received signals include Radio Nacional Lima (844kHz), Radio Colosal, Neiva, Colombia (1025), Radio Nacional Caracus, Venezuela (1055), Radio Paradise, St Kitts (1265), while WXLE on Canton Island in the Pacific is heard on 1385kHz. Many other signals are heard around dusk in New Zealand on split frequencies but identification is difficult due to television receiver interference on some of the channels.

THE PEACE SHIP

After being fitted out at New York and testing on 1540kHz off the coast of the United States (when an appeal was made for financial support) Abe Nathan's Peace Ship has arrived in the Israel area. The ship had a hard voyage across the Atlantic and, after putting into Marseille for repairs, it took up its anchorage 4 miles off the coast of Famagust in Cyprus.

The station is now in regular operation on 1540kHz, broadcasting in French, English and Italian from 1930 to 2115GMT. The English program of popular music conducted by former Radio Caroline disc jockey, Tony Allen, is reported from listeners in Europe who give the mailing address as Voice of Peace, PO Box 1010, Nicosia, Cyprus. The station eventually plans to broadcast in Hebrew and Arabic and try to do its part in resolving the Middle East crisis.

COUNTRIES CHANGE NAMES

In the next few months several countries will make a name change and two in New Guinea will be of greatest interest to us. Papua and New Guinea is to be changed to the Pidgin name for the country, New Gune. The neighbour, the former Dutch New Guinea to the west, was changed to West Irian and now has been named Irian Jaya.

The Philippines is also scheduled to make a name change and will be known as Mahasika. Ceylon is getting to be known as Sri Lanka, though the radio is still identified as Radio Ceylon, and few signs of a change are noted in external services. Bangladesh is accepted as the former East Pakistan, while the former Belgian Congo, and later Congo (Kinshasa), is now known as Zaire.

THE VOICE OF HOPE

Adventist World Radio, which uses the slogan "Voice of Hope" broadcasts to Europe over the facilities of Radio Trans Europe. Their block programmed segments have been on the air every day since October 1, 1971.

From the studios in Lisbon, Portugal, their signal is carried by VHF signal to the RTE relay station at Sesimbra, 35 kilometres south of the city. Another VHF link conveys the signal to the transmitter site at Sines, 85 kilometres south of Lisbon.

At Sines the powerful 250,000 watt Marconi transmitter thrusts the Voice of Hope to preselected areas of the European part of the world. The signal also reaches parts of North Africa, the Middle East and Russian Asia.

All responses to their programs are processed at the language center in the country where the program was produced. Nearly a dozen such centers are involved, in addition to the Lisbon AWR studio. Adventist programs also blanket the rest of the world from a variety of radio outlets including FM, medium and short-wave stations.

Recently the station added an additional program in English which is broadcast at 0945GMT on Sunday. This new time follows the English progam at 0930 which contains DX News and other station information. The DX Session is also heard on Sunday at 0500GMT on 9640kHz, while the transmission at 0930 is on 9670kHz.

Recently the station offered an EP recording to its listeners and already 3,000 of these have been posted out. A further pressing of the 6-language music disc is available to listeners who report on the reception of the Voice of Hope and send their requests to The Voice of Hope, Box 5409, Paris 9, France.

MEDIUM-WAVE NEWS

NEW ZEALAND: The seventh private commercial station has been licenced to operate from Wellington by the Broadcasting Authority. It is expected that this will be the last private station to be licenced, due to a change in the Government policy.

The new station will broadcast from 1730-1200GMT daily, and from 1830-1100GMT on Sunday. Two competing radio companies combined (Radio Wellington and the Hutt Wellington Broadcasting Company) and after finding a new transmitter site to which the NZBC did not object the licence was granted. The station is expected to commence operation on November 1st, on 1080kHz using 5kW.

HAWAII: The new Honolulu station KISA on 1540kHz has been heard opening at 1600GMT with all programs in Tagalong with English announcements for station identification only. Frank Wilson of Dunedin NZ has verified KISA; his report was the first received by the station from anyone, so he can lay claim to be the first in the world to verify KISA.

Continued on Page 125

Notes from readers should be sent to Arthur Cushen, 212 Earn Street Invercargill, New Zealand. All times are GMT. Add 8 hours for WEST, 10 hours for EAST, and 12 hours for NZ.

POCKET CALCULATORS from $59.95

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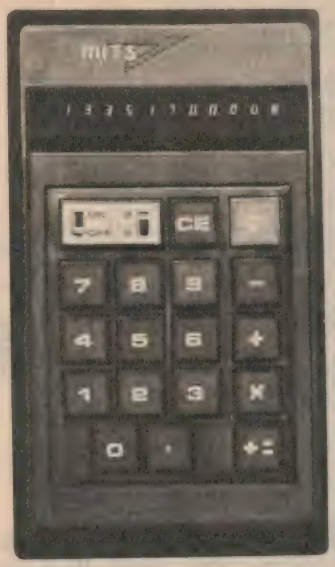

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External printer and programmer available soon.
Students are eligible to purchase this calculator Tax free, ask for our exemption form.

MODEL 1240 DESK CALCULATOR four functions plus one memory register with 4 separate controls, can be added to, subtracted from, recalled to display or cleared without clearing the calculator. 12 digit Sperry display. Price: Kit **$119.95** assembled **$139.95** +14% Sales Tax.

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7475 LATCH	$1.30 +A
7447 7-SEGMENT DECODER	$1.98 +A
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DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
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DC Current: 25uA, 5mA, 50mA, 500mA
Resistance: 10K, 100K, 1M, 10M.
Decibels: —10 +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

MODEL RH-100 $39.75. Postage $1.00

100,000 Ohms per Volt DC 10,000 Ohms per Volt AC

• Overload-protected by dual silicon diodes • Double-jewelled ± 2 per cent meter • ± 1 per cent temperature-stabilised film resistors • Polarity changeover switch • Mirror scale • Instructions for operation with circuit diagram.

SPECIFICATIONS:
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200 (100,000/V).
AC Volts: 6, 30, 120, 300, 1200 (10,000/V).
DC Current: 12A, 300A, 6mA, 60mA, 600mA, 12 amps. AC Current 12 amps.
Resistance: 20K, 200K, 2M, 20M.
Decibels: —20 to +17, 31, 43, 51, 63.
Accuracy: DC ±3 per cent. AC ± 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

"HANDYMAN" RH150 $11.50

CHECKED PACKED & POSTED $12.00

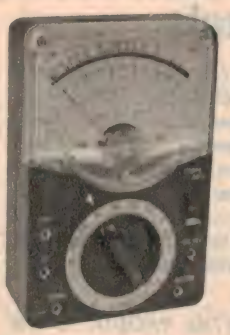
Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS:
DC Volts: 2.5, 10, 50, 250, 1000. 10,000 ohms per volt
AC Volts: 10, 50, 250, 500, 1000.
DC Current: .1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: —20db, +62dB, 0.7KHz.
Capacitance: .0001, .01, .0025, .25uF

MODEL RH-20 $15.00 Packing & Postage 75c

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current, 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7M.
Decibels: —10, +22 (at AC/10V) + 20, +36 (at AC/50V). Upper frequency limit 7KHZ
Batteries: Two 1.5V dry cells.
Complete with test leads

MODEL RH-80 $20.00 Packing & Postage 75c



20,000 Ohms per volt DC.
10,000 Ohms per volt AC.
Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: —10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

• Overload protected by dual silicon diodes • Double-jewelled ±2 per cent meter • ±1 per cent temperature-stabilised film resistors • Mirror scale.

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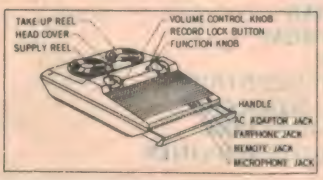
400 feet $1.00



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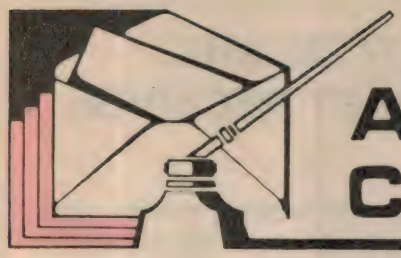


ANSWERS TO CORRESPONDENTS

TOLERANCE: In most of your projects, you state that the resistors used have "10pc tolerance." Unfortunately, I have trouble obtaining resistors with 10pc tolerance and so use 5pc types. How does this change affect the performance of your projects? Who sells 10pc types? The suppliers I deal with sell only 5pc types. Also, what happened to the "Answer Man." (I.Y., West Cairns, Qld.)

The whole subject of tolerances is based on the need to specify a component which is sufficiently accurate for the job, but not more expensive than it needs to be. With the exception of some precision projects (such as the Digital VOM in the January issue) 10pc tolerance components — or even 20pc in some cases — are quite adequate.

The lower the tolerance of a resistor, the closer it will be to its marked value. For example, a nominal 1k resistor with a tolerance of 20pc will be 1000 ohms plus or minus 20pc of 1000 ohms. In other words, it may have a value anywhere from 800 to 1200 ohms. The same resistor in a 10pc tolerance will have a value somewhere between 900 and 1100 ohms. A 5pc type 950 to 1050, and a 1pc 990 to 1010 ohms. Most circuits require only 10pc, but there is nothing to stop you using a lower tolerance type should you desire. It can only make things better, not worse. On the other hand, don't expect any shattering improvement in performance; it will be far too subtle to be noticed.

The "Answer Man" column was deleted to make way for other sections of the magazine — such as the Home Study Course, Elementary Electronics, etc.

DECODER: I have just finished building the 4-channel decoder described in the November 1972 issue and it has turned out to be a pure delight. I am most happy with it, so much so that I went straight out and bought a new pair of rear speakers. May I ask you how the rear speakers should be phased relative to the front pair? I have carefully watched all connections for polarity as shown on your circuit, but is this enough? Congratulations on an excellent magazine. (L.J., Christchurch, NZ.)

There is no way to predict the correct connections, to ensure proper phase, in such a situation. We suggest that the front speakers be phased relative to each other, using time honoured methods, and that the rear pair be similarly phased relative to each other. From here on it is largely a matter of subjective judgement as to whether the phase of the rear group is correct with respect to the front group. Trial and error will be necessary, paying particular attention to the bass response as observed in typical listening positions.

MISTAKE?: I built the 4 channel decoder described in the November 1972 issue. It is a splendid unit. However, I am wondering if you have made an error in regard to one of the components. At the left rear output, you show a 0.01uF capacitor connected to the collector of TR2, while the right channel shows a 0.1uF in the same position. Should they both be 0.1uF? (L.J., Christchurch, NZ).

There is no error, L.J. The capacitors must be of the values shown to obtain the correct phase relationship between the channels.

CDI: Can you tell me the difference between a negative and positive chassis CD ignition system as regards coil windings and component placement? I have a 6V positive chassis coil and wish to build a CDI based on that shown in your Nov 71 issue. What changes would I need to make? Is the BT101 500R the same as the BT101 500 as advertised in the same issue? Also, you mention that "if all is well the converter should emit a whistle . . . if not swap the base connections and it should start." Can you explain this? (G.N., Greensborough, Vic.)

Your question is a little too general to answer properly, G.N There is usually no difference in the coil, but there is in other components. We cannot undertake special research or modifications to existing projects (we do have a magazine to produce!) The BT101 / 500R is not the same as the BT101 / 500 — the anode and cathode connections are swapped. We cannot explain the statement much more — it is self-explanatory. If you hear a whistle, the converter is working. If not, one of the windings is probably out of phase and swapping the base connections cures this, by providing the correct feedback polarity.

STATION LIST: Your list of broadcasting stations published in the January issue each year is very useful. However as an amateur of long standing, I would like to be able to paste the list on cardboard and hang it on the wall of the shack. At present I can't do this, however, because you print the explanatory notes on the back. Could you arrange things a little more helpfully in future, please? I have been getting your magazine for over 30 years now — keep up the good work. (W.M., Leigh Creek Coalfield, SA.)

Thanks for the compliment, W.M., and we will see whether we can do as you ask. It is not always possible to layout the magazine to allow for all contingencies, as much as we would like to, but when we know of reader preferences, we can at least try!

BLINKER: I need a blinker for a vehicle. The output power would have to be approximately 50 to 60 watts at 12V with a repetition rate of 1 pulse per second. (D.L., Chester Hill, NSW.)

You have two approaches. The first is to use a rotating distress beacon of the type used by the police and ambulance and available from at least one of our advertisers quite cheaply. The other is to use a standard automotive traffic indicator flasher unit and a suitably rated lamp in an appropriate housing. We have published two articles on electronic flasher circuits, but neither could be called high power. The first was in March 1969 (File No 3 MS 16) and the second in August 1971 (File No 3 MS 26). Copies of both articles are available at the usual fee from our Information Service.

TA20C AMPLIFIER: I have built the Playmaster 134 guitar amplifier but have used the TA20C hybrid IC instead of the TA20B. I found that when a chord was played, the signal faded from full volume to no volume after about 3 seconds and then after another 3 seconds it came back to full volume. I am not sure whether it was a quirk of the circuit or a faulty component but I finally cured it by placing a 22uF electrolytic in series with the 47uF electrolytic which is connected via a 1k resistor to pin 7 of the IC. Could you please tell me whether this was a good thing to do and why it helped. (M.M., Belrose, NSW.)

We are not sure whether you have a faulty IC or not, but either way it seems likely that you were overloading the unit at low frequencies which caused it to cut off for a short period. By adding the 22uF electrolytic you have reduced the low frequency response of the amplifier and thus the likelihood of overload.

ORGANS: I have been reading EA for some time, but I haven't as yet sighted a project or circuit for an electronic organ. Could you please tell me where I might be able to obtain such a circuit? (R.B., Freemans Reach, NSW.)

We described an electronic organ in the early sixties, but parts for this are now rather hard to get. The main reason we are wary about doing another one is that many readers start building, then realise the magnitude of the task and give the game away. An electronic organ is a very big project for the average home constructor. As well as this, many specialised parts have to be obtained. At the moment an organ project doesn't look promising.

"ELECTRONICS AUSTRALIA" INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2). A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 50c per issue-reprint. Thus, a project spread over three issues will cost $1.50. Reprints are available for all projects, but no material can be supplied additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 30c per page.

SUBSCRIPTIONS, BINDERS, HANDBOOKS etc: These are handled by separate departments. For fastest service, send separate orders to the departments concerned.

PHOTOGRAPHS, METAL WORK DRAWINGS: Original photographs are available for most projects. Price: $1 for 6in x 8in glossy print. Metal work dyelines are available for most projects. Price: $1. These show dimensions and positions of holes and cut-outs, but give no wiring details.

PRINTED WIRING PATTERNS: We can supply transparencies, actual size, positive or negative, as specified. Price: 50c. We do NOT deal in manufactured boards. These are available from advertisers.

BACK NUMBERS: As available. On issues up to six months, face value. Seven months to 12 months, face value plus 5c. Thirteen months or older, face value plus 10c. Postage and packing, 10c per issue extra. Please indicate if a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 50c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not deal in electronic components. Prices, specifications, etc should be sought from appropriate advertisers or agents.

REMITTANCES: These must be negotiable in Australia, and should be made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque, endorsed with a suitable limitation.

POSTAGE & PACKING: All charges shown include postage and packing, unless otherwise specified.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 157, Beaconsfield 2015.

(8 / 73)

ANSWERS

COMPLIMENTS AND QUESTIONS: I would like to thank you for a very well-planned magazine. It has something for everyone — the beginner, dabbler and expert. Other Australian magazines have too many "product tests" and not enough projects. Could you tell me what "state-of-the-art" means? Also, have you published a simple short-wave receiver? Is there any way of testing a capacitor for value? How can one find out what the inside of an IC looks like? Is it possible to use just a part of an IC in a project? Also when sending for project reprints, is it permissible to pay in stamps, as postal orders cost so much these days? (M.R. Craigie, WA.)

Thanks for the compliments, M.R. We are glad you like the contents and format of the magazine. "State-of-the-art" means the present knowledge and technology in a particular field — in our case, electronics or a branch of it. The 1970 All-Wave Two (File No 4/TR2/5) published in April 1970 is about as simple a short-wave set as one could get. One transistor and one IC are the only active components! (Reprints are available.) A simple capacitance bridge may be used to check the values of capacitors. Our last one was described in the April 1968 issue (File No 7/B/9).

We are not sure what you mean by "the inside of an IC." If you mean circuit-wise, this information is usually available from the manufacturer or distributor. If you mean physically, then the only way is to carefully break one open (preferably a dud) and look! (You will probably need a microscope.) It is possible to use part of an IC, depending on the circuit. Notice, for example the Digital VOM (January 1973.) On the circuit there are a number of parts with ¼ before them — meaning that only ¼ of the IC is used in that part. The odds are the rest will be used elsewhere in the circuit — otherwise they are wasted. Stamps are quite permissible — as is any form of negotiable payment in Australian currency.

CDI: I have a few questions regarding CDI systems: You have stated that the CDI doubles the output voltage from the coil — on a sports coil which, say, delivers 40,000V already, would it be desirable to use CDI, which would then produce about 80,000V? Is there any chance of arcing in the distributor cap with CDI? Is there any need to change the standard points gap? What is bifilar winding? If this system were used in a V8 engine, would there be any need to decrease the gap from the 0.05in indicated in your Aug. 70 article? How much would the ignition timing need to be retarded for a V8 engine? How could this be worked out exactly? (C.M., Campbell, ACT.)

A sports coil should not be used with CDI. There would be a very high risk of crossfiring, arcing over, breakdown and other troubles. Because CDI places a much greater voltage stress on the electrical (ignition) system, the latter must be in perfect order. The points gap should be set as stated by the manufacturer, but with CDI this becomes less critical. Bifilar winding is where two wires are wound side by side as if they are one wire. We see no reason to change the plug settings, but this (and your other questions) are more a matter for a tuning shop.

NOTES AND ERRATA

PLAYMASTER 127 CONTROL UNIT (November, 1969, File No 1/SC/8) some units are unstable when switched to the "tape" position. This may be cured by removing the tape input leads from the DIN socket and terminating them on one of the "radio" sockets. The leads from the radio socket may then go to the vacated pins on the DIN socket.

RECORD REVIEW: "The World of Albert Ketelbey" reviewed in the May issue, is a Decca release, number PFS-4170.

130 RECEIVER (April, 1972, File No 2/SW/62): The .002uF capacitor in the parts list should read .022uF.

FERGUSON TRANSFORMER: The transformer announced in the New Products section of the March 1973 issue (p.105) should have the type number MT552.

TWO PLAYMASTER 138 PROJECTS: Due to an oversight, there are two projects with the "Playmaster 138" designation: the Program Source tuner of December 1972 (File No 2/TU/33), and the Guitar Amplifier of May 1973 (File No 1/GA/20). Readers are warned not to confuse the two projects concerned, especially when ordering kits of components or metalwork.

EXPERIMENTER'S AMPLIFIER: Have you ever published an amplifier suitable for experimenters? One or two watts would be satisfactory. Would the amplifier from the Solid State Fremodyne be suitable? Would an impedance matching stage be necessary with a radio which uses a crystal or magnetic earpiece? Have you published an amplifier which could be run off a 12V 2 amp transformer? If so, what is its power rating. Have you published any R C units suitable for a boat or plane with a range of up to 1km. (I.B., Whyalla Stuart, SA.)

The "Audio Mate" described in the March/July issues of 1972 (File No. 1 MA 49) should be close to what you require. It also includes a power supply suitable for running your experimental circuits. The Fremodyne power amplifier would be somewhat less suitable. There should be no need for impedance matching. We may have published a 12V 2A amplifier, but to find one would mean a long search through our indexes and files. It is, in any case, a very vague description. The last R C equipment we described was in December 1965 and January 1966. We feel these should no longer be recommended, as they are now rather dated.

HIGH QUALITY AMPLIFIER REVIEWS: I appreciate your product reviews as a Hi-Fi enthusiast but wonder why you do not review some of the top grade equipment available. A report on some of this equipment would be appreciated by many readers to provide standards of comparison and obtainable limits related to a number of aspects on which a judgement can be made. Secondly, can you supply any information on a multi stage, octave equaliser, audio frequency contourer? (Indecipherable signature, RANC, HMAS Creswell, Jervis Bay, NSW 2540.)

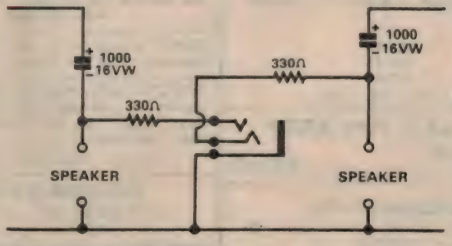
Our product reviews must generally be limited to those items which are submitted to us. If manufacturers or dealers elect not to submit their products, there is little we can do about it. Concerning your second query, we regret that we have no information. It may be worthwhile approaching the manufacturers of commercial units, or perhaps referring to copies of overseas journals in your local library.

PRE-AMPLIFIER: I am presently engaged in a project using a National LM380 IC amplifier and require a circuit for a preamplifier to boost the output of a 4in loudspeaker used as a microphone, to the level of a crystal cartridge. I would also be grateful if you could supply a speed control circuit for a turntable. (M.T., Mitcham, Vic.)

We would suggest an ordinary microphone preamplifier with a gain of around 100. A suitable circuit would be the preamplifier published in March 1972, which had adjustable bass response. (File No 1 PRE 27). Copies of the article are available from our Information Service at the usual fee. Alternatively, it might be possible to avoid using a preamplifier by fitting the speaker with a conventional speaker transformer to provide a stepup ratio. Unfortunately, we cannot supply information on turntable speed control circuits.

HEADPHONE JACK: I have successfully built the low cost stereo amplifier featured in January 1972 and now wish to add a headphone jack. Could you please advise me of the necessary circuitry? (D.B., East Preston, Vic.)

A headphone socket may be added very simply with the addition of two 330 ohm resistors to the existing circuit as shown in the diagram. No dummy loads are required in place of the loudspeakers during headphone listening.



ERRATA: Having just read your Notes and Errata column in the May issue, I wonder if readers are supplied with these amendments when purchasing project reprints? (J.F., Wickham, WA)

Yes, J.F., we go to some trouble to file all such notes with the master copies used for our reprint service. In this way the notes are copied automatically when a reprint is made.

Continued on Page 127

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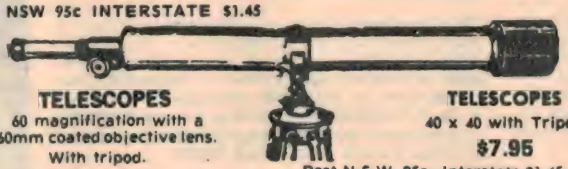

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Listening from p.118

BRUSSELS USES 9655kHz

Station ORU, Brussels, Belgium has been noted on a new frequency for their two transmissions in English; this differs from that announced by the station. According to the May 6 schedule the English broadcasts were to be carried on 9550 and 15235kHz, but we have been receiving the new frequency of 9655kHz which replaces 9550kHz for the period 2300-0100GMT at very good strength.

English programs are heard daily from 2300-2315GMT and again from 0040-0100GMT. On Friday at 0040GMT a mail-bag session is presented and requests are made for reception reports to PO Box 26, Brussels, Belgium.

CZECHOSLOVAKIA: One of our listeners at Tinonee, NSW. Ron Knott reports on reception of Radio Prague in their transmission to Australia and New Zealand. At the present time only three frequencies are being used; these are 11855, 15310 and 21700kHz. The English program for the Pacific is broadcast from 0700 to 0800GMT.

Total communications from p.18

of the United States, in absolute terms, during the last half of the 1970s — something that would have been unimaginable just ten years ago.

All of the international implications of Japan's emergent leadership in telecommunications are not clear, by any means. But this much is certain: with a multi-billion home market for advanced telecommunications products, and the heavy outlays for a well-orchestrated R&D program it will make possible, the Japanese industry will have formidable international competitive power. Moreover, as telecommunications becomes increasingly a global activity, Japan can be expected to play an important role in extending the information revolution to other parts of the world, not only through the sale of products and the transfer of the necessary technology, but also in the development of vital new international communications organisational structures that will be needed to maximise the benefits of total communications to humanity as a whole.

"Communications," says NEC's Dr Koji Kobayashi, "must become world communications. It can no longer be organised on national lines. By the turn of the century a total global communications system can be a reality. We have the basic technology in microwave and satellite systems. Laser communications will increase our communications capabilities even further. What are needed now are new approaches to organising efficient global communications systems."

VHF converter from p.33

Whatever aerial system is used, it should be cut to suit the frequency of interest, or when a band of frequencies is to be considered, then the aerial should be cut to suit the middle of the band.

As a bare minimum, a simple folded dipole may be made up from 300 ohm TV ribbon, with both ends shorted and one lead cut in the centre to connect in another length of ribbon, which acts as a feeder. The dipole length is calculated by dividing the desired frequency in MHz into 14,070, which gives the answer in cm. When constructed, the dipole section may be tied or otherwise fixed to a piece of wooden dowel for support.

Strictly a 300 ohm-to-75 ohm balun should be used to match the balanced feeder to the converter input. However this could probably be omitted if desired, and the feeder connected directly to the converter aerial input and earth.

A little practice will be required to tune this converter. The tuning will appear to be rather sharp and the degree of this will depend upon the actual bandwidth being covered. If you only have to tune say from 52 to 54MHz, then tuning will be much easier than if you are tuning from 118 to 136MHz — 2MHz as compared with 18MHz. Another point to remember is that the system is limited by the ability of the main receiver as far as modulation resolution is concerned. This applies particularly to frequency modulation. More than likely, the TV sound channels will sound distorted, due to the fact that TV sound uses a wide deviation and the selectivity characteristics of the receiver will probably be quite narrow. This is an important point to remember when evaluating the overall system.

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Bargain 100 YF 250V Pigtail 26c .022, .047, YF 400V Poly 10c resistors Philips ½W, 4C, 1W, 6C most values magnetic cartridge, $7.50; SHURE M91E cart $40, 2¾ speaker, 15 ohm, 25 ohm, 40 ohm, $1.99, add 20c p. post, extra for heavy parcels. Quantity disc. BRYSTAN SERVICE P L, 12 Gordon Ave, Geelong West, 3218. Phone 91524.

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Public Address Amplifier AWA model PA 1005 12.5 watts with ceramic microphone and 4 speakers. Excellent condition $50. PO Box 360 Brookvale, NSW 2100.

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Crystals for CB 27.240 and 26.785 MHz, ¼in pin miniature $6 pair Post free Shalley, 127 York Street, Sydney.

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Byer Tape Recorders ex broadcast use mark II mod 77 $390 — mark 1 mod 77 $165 — mark II mod 66 with built-in radio tuner $300 — F.A.S. C O 4GY, Mary St, Gympie 4570. Phone 822346 a h 821183 (Std 071), S. L. FITTELL, 78 Channon St, Gympie, Qld 4570.

Zener Diodes ¼W, sil & germ trans untested, all 15 for $1, stereo tape heads $3 pr **SURTRAN,** Box 317, GPO SYDNEY.

SONY AV 3600 videorecorder and SONY monitor TV receiver as brand new. Retails over $700. Bargain at offers over $350 phone SYDNEY 858 1874. N. C. PAYOE, 4 11 Riverview Street, West Ryde, NSW 2114.

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Cossor Mod 1035 cro Mains Tx Wanted. part no MC413037 or any helpful suggestions, George Richings, 156 Ferrars St, South Melbourne, VIC 3205.

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ANSWERS from P.123

LAWN POWER: I have found that if I stick the probes of my multimeter in the lawn and set it for 0.25V I get a reading of ½ volt. I tried moving the probes slightly and the meter reversed. I then tried running a small oscillator circuit from it — it ran for five minutes before running out. Could you explain this? I asked two people. One said, "It's all the shocking people around", and the other said, "It's electric worms". (P.J., Hawthorn, Vic.)

It is not really possible for us to give an explanation of your observation without being on the spot. It is possible that there are heavy earth currents in your vicinity or there may be an electrolysis action in the soil. We doubt that either of the other suggestions offered are valid explanations, though.

PIC. TUBE REJUVENATOR: In the May issue of Electronics Australia, a reader, T.S., of Waikerie, SA, was enquiring about a circuit for a picture tube rejuvenator. The answer is to be found on p109 June 1969 issue of "EA". (P.F., Crawley, WA.)

Thanks to our correspondent from Crawley WA, there is your answer, T.S.

E-A Guide to Component Suppliers

As a service to readers, Electronics Australia publishes below a list of firms who stock components suitable for our construction projects. Some may specialise in particular types of component, or in kitsets, while others may be comprehensive stockists. For further details about any specific firm, readers should refer to their advertisements.

NEW SOUTH WALES

A.C.E. Radio Pty Ltd, 136 Victoria Rd, Marrickville, 2048. Phone 51 7008.

John Carr Pty Ltd, 405 Sussex St, Sydney (PO Box K39, Haymarket 2000). Phone 211 5077.

Edge Electrix, 25A Burwood Rd, Burwood 2134. Phone 747 2931.

Dick Smith Electronics Pty Ltd, 162 Pacific Hwy, Gore Hill, 2065. Phone 439 5311.

Kitsets Australia (Sydney) Pty Ltd, 400 Kent St, Sydney and 1st Floor, 21 Oaks Ave, Dee Why (PO Box 176, Dee Why 2099). Phone 29 1005, 982 7500.

MS Components, 95-97 Regent St, Redfern, 2016. Phone 69 5922.

National Radio Supplies, 332 Parramatta Rd, Stanmore, 2048. Phone 56 7398.

Pre-Pak Electronics Pty Ltd, 718 Parramatta Rd, Croydon, 2132. Phone 797 6144.

Radio Despatch Service, 869 George St, Sydney 2000. Phone 211 0816.

Radio House Pty Ltd, 306-308 Pitt St and 760 George St, Sydney 2000. Phone 61 3832, 211 0171.

RCS Radio Pty Ltd, 651 Forest Rd, Bexley 2207. Phone 587 3491.

Wardrope and Carroll Fabrications Pty Ltd, Box 330, Caringbah, 2229. Phone 525 5222.

VICTORIA

E.D. & E. Sales Pty Ltd, 118 Lonsdale St, Melbourne, 3000. Phone 662 3506.

Imported Components, PO Box 1683P, Melbourne 3001.

Kitsets Australia (Vic) Pty Ltd, 271 Bridge Rd, Richmond. Phone 42 4651.

J. H. Magrath, 208 Little Lonsdale St, Melbourne, 3000. Phone 663 3731.

Radio Parts Pty Ltd, 562 Spencer St, Melbourne 3000. Phone 329 7888.

SOUTH AUSTRALIA

Gerard & Goodman Pty Ltd, 192 Rundle St, Adelaide, 5000. Phone 23 2222.

Kitsets Australia (SA), 50 Grenfell St, Adelaide, 5000. Phone 87 5505.

QUEENSLAND

Kitsets Australia (Qld) Pty Ltd, 293 St Paul's Terrace, Fortitude Valley 4006. Phone 52 8391.

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